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ACID RAIN AND NONATTAINMENT ISSUES

HEARING

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION

OF THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

TO HEAR FROM HON. LEE THOMAS, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY ON THE SUBJECT OF ACID RAIN AND NONATTAINMENT ISSUES

APRIL 22, 1987

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ACID RAIN AND NONATTAINMENT ISSUES

WEDNESDAY, APRIL 22, 1987

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION,
Washington, DC.

The Subcommittee on Environmental Protection met, pursuant to notice, at 9:30 a.m., in room 406, Dirksen Senate Office Building, Hon. George Mitchell (chairman of the subcommittee) presiding.

Present: Senators Mitchell, Simpson, Burdick, Chafee, Baucus, Lautenberg, Stafford, Graham, and Durenberger.

OPENING STATEMENT OF HON. GEORGE J. MITCHELL, U.S. SENATOR FROM THE STATE OF MAINE

Senator MITCHELL. Good morning, ladies and gentleman. The hearing will come to order. Good morning, Mr. Thomas, gentlemen, welcome.

The United States faces two serious air pollution problems which must be addressed this year. The first is the inability of many areas to attain compliance with the requirements of the Clean Air Act by the deadline at the end of this year. The second is acid rain.

This morning we will hear from Lee Thomas, the Administrator of the Environmental Protection Agency, on both of these issues.

Acid rain adversely affects our health, our lakes and streams, and possibly our forests. As I have said repeatedly, we must reduce the pollutants that cause acid rain if we are to avoid irreversible damage to the health of the American people and the environment in which we live.

For 7 years the Reagan Administration has opposed any action to control acid rain on the increasingly flimsy pretext that more study is needed. In recent weeks, two statements have been made on this subject by Administration leaders which have added to the confusion.

In an address to the Canadian Parliament, President Reagan said for the first time that he would consider a treaty with Canada that would require reductions in the emissions of pollutants that cause acid rain. That's what the Canadians have been seeking for nearly a decade. This was hailed by the Canadian Government, particularly by Prime Minister Mulroney, as a major breakthrough. But a short time before the President was speaking to the Canadians you, Mr. Thomas, were reported by the Wall Street Journal to have told several Members of Congress that "You may not need to bring down emissions at all."

I hope today that you will answer at least the following questions.

First, did you say what the Wall Street Journal reported that you said?

If so, did your statement represent Administration policy?

What did you mean?

What message did you intend to convey?

As to the President's statement in Canada, does it in fact represent a major breakthrough as claimed by the Canadian Government? Does it represent a change in Administration policy? Or, as some skeptics have suggested, is it intended to mean one thing in Canada in an effort to help a political friend who is hurting at home, without any real change in policy here in the United States?

One thing is clear. The President's statement cannot be both a major breakthrough in Canada and no change in policy in the United States. The two propositions are mutually exclusive. If the Administration has not changed its policy on acid rain, then the President's statement to the Canadian Parliament is meaningless. Conversely, if the President meant what he said, then there must be a change in policy here, and your reported statement to Members of Congress is inconsistent with that changed policy.

You cannot credibly offer the Canadians good faith consideration of reduced emissions and at the same time tell Americans that no reductions in emissions are necessary. We hope you will tell us today, either in your statement or in the question and answer period, as you choose, what the Administration's current policy is on acid rain.

The second major air pollution problem we must address this year is nonattainment. Many cities will not meet the national air quality standards by the end of the year as required under the Clean Air Act. This has been the requirement since the act was last amended 10 years ago.

An estimated 100 million Americans live in areas where the air exceeds the health-based standards. In some cases, people are breathing air that is three times as unhealthy as Federal standards permit. We must find a way to bring these areas into compliance and protect the American people.

EPA recently sent a letter to affected States warning them that their plans for meeting the standards would be scrutinized and corrective action could be required. This is a helpful step, for which I commend you. However, as long as five years ago EPA was aware that many areas would not meet the deadline. In that time, little was done to help States to meet the deadline. The recent letter seems to be too little and much too late.

If EPA reviews a State plan and finds it inadequate, over a year will be needed to put into place needed changes. EPA has to go through the rulemaking necessary to formally determine that the plan is inadequate. States will also need time to develop revised plans for bringing their areas into attainment. The EPA review would have been more helpful if it had been completed in time for areas to revise and implement their plans, reduce emissions, and meet the December 31, 1987 deadline.

Just two weeks ago, eight months before the deadline, EPA sent a proposal to the Office of Management and Budget for controlling

refueling emissions. This leaves just eight months to press a major regulatory change through the bureaucracy, which normally takes at least two years. And that doesn't even take into account the current Office of Management and Budget. The States must then implement the change. This is not enough time.

I am concerned that EPA may be taking action too late to help States avoid sanctions. While implementation of the Clean Air Act is a joint effort by both the State and Federal Governments, we know from experience that pressure from the Federal Government, appropriately applied, can produce meaningful results.

One example of this is the federally-imposed phasedown on leaded gasoline, which has dramatically lowered the levels of lead both in the air and in humans. Lead presents a serious health threat and this reduction is a result of your leadership, for which you and all Americans can be proud and for which I—and I believe all members of this committee—commend you for the forthright and aggressive action that you've taken in that area.

I look forward to working with you and the EPA to develop a solution that will be, hopefully, as aggressive and meaningful in the areas of acid rain and nonattainment.

Senator MITCHELL. I'd like now to recognize the distinguished chairman of the committee, Senator Burdick. Senator, welcome.

OPENING STATEMENT OF HON. QUENTIN N. BURDICK, U.S. SENATOR FROM THE STATE OF NORTH DAKOTA

Senator BURDICK. Thank you, Mr. Chairman, Mr. Thomas, members of the panel.

Today's hearing addresses acid rain and nonattainment, the major issues of the Clean Air Act in 1987. The Clean Air Act has not been reauthorized or substantially amended since 1977. Deadlines created in that statute are upon us. We have learned much about implementing the act. It is time to profit from that experience, and in this decade acid rain has emerged as an issue with which the Nation must deal.

Now, with the continuing failure of the Environmental Protection Agency to make key regulatory decisions or to provide meaningful assistance to States and communities faced with the act's deadlines, it is time for legislative action.

The heart of the nonattainment problem is that millions of people continue to be exposed to levels of air pollution above the health-protective ambient standards. To avoid the construction ban and highway funding sanctions, extension of the December 31, 1987 deadline will be necessary for communities that have tried hard and still have not yet made the standards.

We intend to complete action on the clean air legislation before the end of 1987 to spare these communities the dislocation that could result from the sanctions. The number and length of those extensions must be held to a minimum, however, and communities will have to commit to extra efforts to receive them. It is not realistic to expect that they will be able to reach attainment without further Federal assistance as well in the form of stronger national control requirements, on mobile sources, and regional emission problems. This is an area where witnesses have told the subcom-

mittee that delay and indecision by EPA have compounded their difficulties in coming into attainment.

We want to cooperate with the Agency in developing a legislative program to help bring all communities into attainment of the health-protective standards at the earliest possible time. This is an invitation to EPA to stop being part of the problem and become part of the solution. That invitation could extend to the acid rain question, as well. Congress has wrestled with this issue for 6 years. EPA has offered very little help. The accommodation of the interests of the west, the midwest, and the northeast will not be easy.

EPA could contribute to this debate, but only if the Administration is finally ready to address the necessity of acid rain controls.

I hope that this is the meaning of President Reagan's recent commitment to Canadian Prime Minister Mulroney, and I look forward to Lee Thomas' testimony and how this commitment can be carried out.

Thank you.

Senator MITCHELL. Thank you, Mr. Chairman.

We are pleased to have with us this morning the distinguished deputy minority leader, who is a valuable member of this committee, and we look forward to his opening statement.

OPENING STATEMENT OF HON. ALAN K. SIMPSON, U.S. SENATOR FROM THE STATE OF WYOMING

Senator SIMPSON. Mr. Chairman, thank you, and Chairman Burdick, I thank you. I'm very pleased, George, that you're going ahead and making this diligent effort to gather information from all sides of the acid rain issue. It looks like the committee will make another run at that this year, and I would surely hope that we might find it to be more productive than we have in the past.

I think that people must realize that we've been hammering around on reauthorization of the Clean Air Act for about 6 years without making any progress on the floor, and that legislative gridlock has been caused by a polarization which results from the various interest groups taking extreme positions on clean air legislation. I think many of us—I know you are, and I know John Chafee and so many of us, and our ranking member, Senator Stafford—were very interested in breaking this legislative gridlock. But to do so, we're going to have to put forward some legislative proposals which finally cut through the rhetoric and the hype and the hurrah and the emotion and the fear; those are strategies which have been used in the past with good results, while we just do nothing, which prevents us from having something with maximum flexibility and lowest cost.

I note that in recent communications from the National Clean Air Coalition that several Senate bills are now touted as providing flexible, least-cost approaches to the acid rain problem, and I must say with complete humility that Senator Proxmire and I have submitted a dazzling bill there that, I think, provides a great deal of flexibility and the least cost. It is not an industry bill, and I am offended when it is referred to as such by those who would detract from it. Nothing could be further from the truth. No industry representative ever urged Senator Proxmire or me to put together this

bill. I want that to be part of the record. That is babbling that is unwarranted. I think it's a genuine attempt to address a critical and an environmental problem in a common-sense manner.

And Finally, Mr. Chairman, another topic that concerns me here is that we are talking of this massive clean coal program that's being proposed. I think a clean coal program might be attractive to some as a means of relieving political pressure for acid rain control measures, but I think that clean coal efforts are generally a very long-term prospect and we can't expect any significant emission reductions to result from any clean coal program. That's just not a western State talking, that's the second largest coal producer in the United States speaking. I just think we must take a close look at that.

I thank you, Mr. Chairman. I have come to know you and to work with you, and I know that your evidence of fairness will be clear in this situation. I am pleased that Lee Thomas is here today; maybe he can help us take the best from many sources on this bill. I think he's brought great credibility and a fresh perspective to environmental debates, and I think you have been a splendid Administrator. I look forward to hearing from the Administrator who has, indeed, been very candid and accessible to all of us on this committee.

I thank the chairman.

Senator MITCHELL. Thank you, Senator Simpson.

We are pleased also to have here the distinguished ranking member of this committee, a man who served as chairman of this subcommittee for six years and who, I think it can be said without exaggeration, is more responsible than any other single individual for those actions taken to protect the health and the environment in this country during this decade, and I'm very pleased that Senator Chafee is here. Welcome, Senator, we look forward to your opening statement.

Senator CHAFEE. Thank you very much, Mr. Chairman. I want to join in thanking you and commending you for pressing so vigorously with these hearings. You've done a wonderful job and we look forward to hearing Mr. Thomas this morning.

I do not have an opening statement. Thank you, Mr. Chairman.

Senator MITCHELL. We are also pleased that Senator Baucus is here. He has been very active in this area for several years. Senator Baucus, do you have an opening statement?

Senator BAUCUS. Thank you, Mr. Chairman. I won't take any more time of the committee except to say that there's been a lot of talk around here about the Clean Air Act and acid rain and attainment standards, and I just feel that this is an Administrator who can move if he wants to move. I think he does want to move, and we're here to help him do that. Thank you.

Senator MITCHELL. I want to acknowledge a statement from Senator Pressler which will be made part of the record at this point.

[Senator Pressler's statement follows:]

STATEMENT OF HON. LARRY PRESSLER, U.S. SENATOR FROM THE STATE OF SOUTH DAKOTA

Mr. Chairman, I want to commend you for calling this hearing and thank EPA Administrator Lee Thomas for participating. It is critical that we know the Administration's position on these important environmental issues.

As the Administrator knows, one of my primary interests is the use of alternative fuels to reduce emission in nonattainment areas. I have introduced a resolution calling for the increased use of ethanol and methanol to reduce mobile source emissions and reduce our dependence on imported oil. I also joined a number of my colleagues in writing to Mr. Thomas to urge him to encourage the use of ethanol in nonattainment areas. This is a positive action which could be taken to address the nonattainment problem. It certainly won't solve the problems in all areas but it would help.

I also want to commend the Administration for its recent action on clean coal technology. The development and implementation of innovative new technologies to control sulfur dioxide emissions are essential for an effective acid rain control program. Further action may be needed to deal with acid rain but it is critical that we encourage the development of new technologies.

Again, I thank Mr. Thomas for being here today and I look forward to hearing his comments.

Senator MITCHELL. Mr. Thomas, as you know from previous experience and many statements made to you publicly and privately, you have the confidence of all the members of this committee. We hold you in very high regard, even when we disagree, and we look forward as always to receiving your testimony. Perhaps it might be useful if your associates could identify themselves for the record as well.

STATEMENT OF HON. LEE THOMAS, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY J. CRAIG POTTER, ASSISTANT ADMINISTRATOR FOR AIR AND RADIATION; GERALD EMISON, DIRECTOR, OFFICE OF AIR QUALITY PLANNING AND STANDARDS; RICHARD D. WILSON, DIRECTOR, OFFICE OF MOBILE SOURCES; FRANCIS S. BLAKE, GENERAL COUNSEL; AND FRANK PRINCIOTTA, DIRECTOR, AIR AND ENERGY ENGINEERING RESEARCH LABORATORY, OFFICE OF RESEARCH AND DEVELOPMENT

Mr. THOMAS. Thank you, Mr. Chairman. I appreciate the opportunity to be with you and the members of the committee today to talk about this most important issue.

Let me introduce the people who are here with me, all members of my staff, to assist in answering questions that the committee may have.

On my far right is Gerry Emison, who is Director of our Office of Air Quality Planning and Standards in North Carolina, the office that primarily deals with the States as far as State implementation process is concerned under the Clean Air Act, the office that is largely responsible for setting the standards that we implement and enforce.

Next to him is Dick Wilson who is Director of our Mobile Source Office. As you know, particularly for the pollutants we're talking about on nonattainment, mobile sources are a large contributing part of that issue. Dick is responsible for managing both the standards setting, implementation, and enforcement aspects of the mobile source program.

Craig Potter, who is my Assistant Administrator for Air and Radiation, has appeared before you several times on these issues.

To my left, Frank Blake, the General Counsel of EPA, who is very involved in these issues, particularly in assisting the Justice Department in defending me against the many lawsuits that I have related to these issues, as well as in interpreting the law which you've passed and amended and modified over the years.

Senator MITCHELL. You're probably one of the most sued men in American, aren't you?

Mr. THOMAS. I feel like I probably am, yes. As a matter of fact, I lost count when the current suits passed 350.

Senator MITCHELL. I believe the Bar Association is going to erect a memorial to you.

Mr. THOMAS. On my far left is Frank Princiotta, who is Director of our Engineering Laboratory in North Carolina. He is very involved, and has been over the years, in the development of pollution control equipment. He's been very active in the areas of sulphur dioxide and nitrogen oxides; in other words, the clean coal technology issue which this committee also has had hearings on.

I commend you, Senator Mitchell, for the series of hearings which you have held. The way you've gone about exploring the issues of acid rain, exploring the issues of ozone and carbon monoxide nonattainment I think has been commendable, holding the in-depth hearings that you have, and I appreciate the opportunity to come in today and discuss with you both issues that have been raised from those hearings as well as issues which you raised in your opening statement and others from members of the committee.

What I would like to do today, as far as my verbal presentation is concerned, is just summarize a particular part of my written statement. My written statement talks about the issue of acid rain and the issue of ozone nonattainment in some detail. I feel it's a good representation of where we are on those issues within the Administration.

In that I have made presentations to the committee on acid rain in the past, I would like to emphasize in my opening statement the issue of ozone nonattainment and carbon monoxide nonattainment, on which I have not made presentations to the committee. This is an issue of immediate concern—not that acid rain is not. I'm fully prepared to respond to questions and to discuss the issue of acid rain with the committee at any length and in any depth that the committee would like during this hearing.

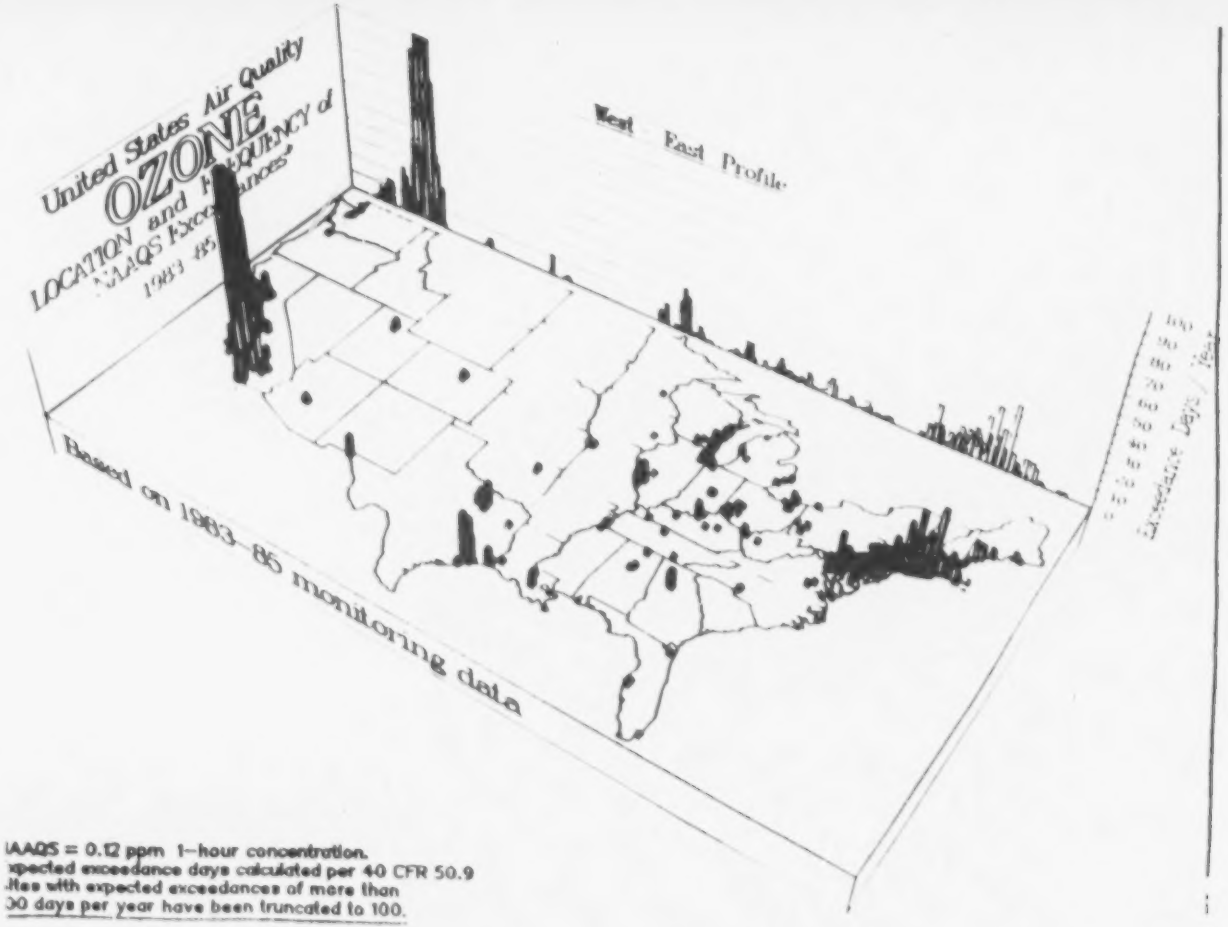
I will say, as far as acid rain is concerned, I agree with you as I have in the past. It is a major environmental issue, and I spend considerable time dealing with that issue, all aspects of it. I have dealt with it at length over the last several months since I was before this committee. On that same subject I have examined the issues of science, what do we know, and I have pushed the scientists to try to tell me as much as they can about what we know on acid rain. I have spent extensive time on the policy issues of acid rain, both domestic and international, in sessions with the President and other members of the Administration, reviewing the current status of the policy. I have spent extensive hours with the staff of our agency and others discussing implementation issues of acid rain legislation, or issues of implementation under the existing Clean Air Act that would deal with precursors of acid rain.

I have spent long hours dealing with technology development as far as clean coal technology and other issues are concerned, as I have spent long hours implementing the existing Clean Air Act, particularly in this case dealing with those issues that relate to acid rain, whether it's sulphur dioxide control, nitrogen oxide control, or ozone control, which has a relationship to the acid rain issue.

So I feel it is a most important issue. I spend considerable time on it. I do not share your opinion about what needs to be done today, as you know. However, I can understand your opinion. I understand it as a different one from my own, and I realize we have reached it from our review of the existing information. I often find that review of existing information brings people to different conclusions about when actions should be taken and what action should be taken in the environmental area. One of the things I have found in my four and a half years with EPA is that issues are not as black and white as they are often presented by people outside of the agency, people who criticize us for one action we take or for one action we do not take. The issues are many shades of gray. I cannot tell you how many shades of gray there are in the acid rain debate, but there are almost as many as there are in the ozone and the carbon monoxide debate.

So let me talk about ozone and carbon monoxide just briefly in my opening presentation.

First, it is an immediate issue. You pointed it out. Under the Clean Air Act, 1987 is the date by which Congress anticipated we would have attainment with the standards that we have set under the Clean Air Act across this country; and, in fact, we don't. I must say that everybody has worked hard towards attaining that standard. State governments, local governments, and EPA—it is not an EPA bashing time; it is not a State bashing time; it's not a Congress bashing time. We have all worked very hard, and there are a whole series of reasons why we didn't make the date. I'd like to talk to you some about what those are, but most about what we do now because, in fact, the standards are important standards to attain. Both ozone and carbon monoxide are health-based standards. They are standards which I feel should be met in this country to protect health; in this case, the primary standard which was set for the protection of the American public. And as you can see, for ozone we're not meeting that standard. This map of the United States reflects the number of days per year that cities are exceeding the current ozone standard, using the three-year period of time between 1983 and 1985. We use a three-year average when we look at attainment status. We don't allow more than one exceedence a year, but we average it over three years.



NAAQS = 0.12 ppm 1-hour concentration.
Expected exceedance days calculated per 40 CFR 50.9
Sites with expected exceedances of more than
100 days per year have been truncated to 100.

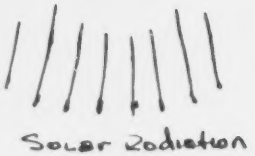
Mr. THOMAS. Now, what you can see is their extremes, from Southern California where we have the biggest issue—and this chart is truncated at 100 days; actually, they go up to 125 to 130 days a year in exceeding that standard, over to the northeast, which is almost one corridor of exceedences from Washington up through the Boston area and into Connecticut; one long area of exceedences on ozone. Then we have the Chicago area, Dallas-Fort Worth, and Atlanta as other areas where we have particular problems, but as you can see, we have problems in many other places, as well. These are areas that have exceeded the standard. That's not taking into account any areas that come close to the standard; it's those areas that have exceeded the standard, and many of them for many days.

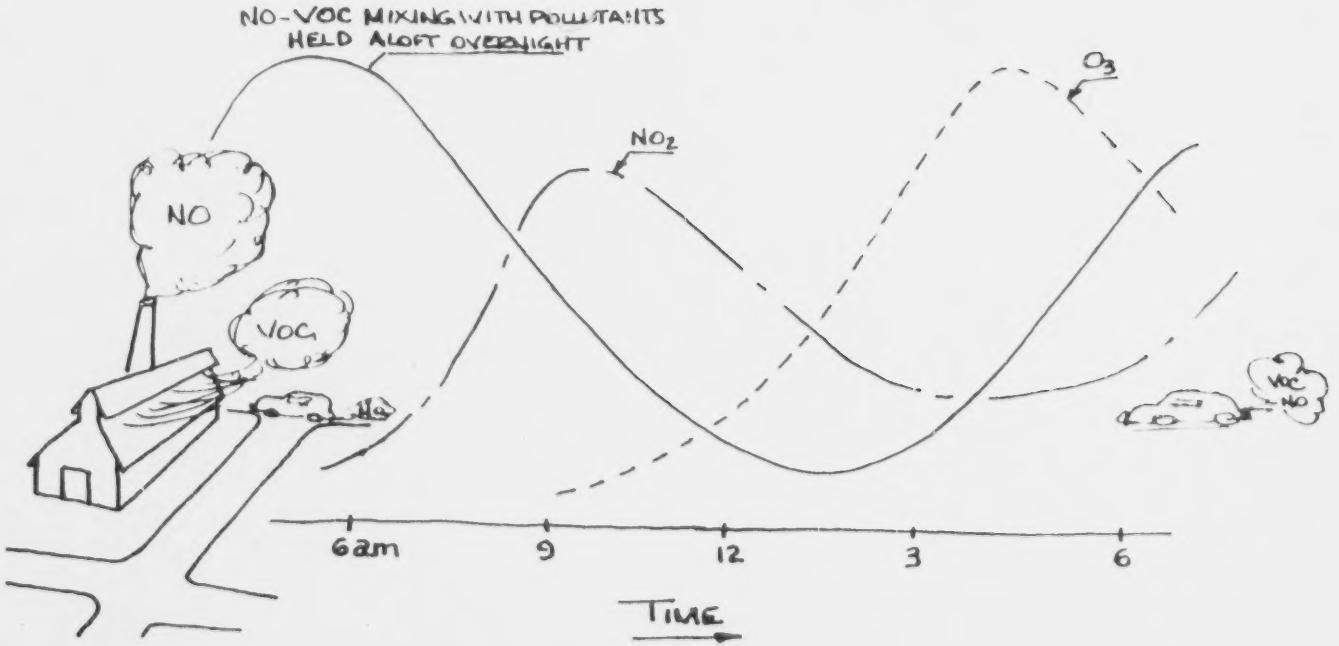
As you can see from this next chart, one of the reasons we have a problem with ozone is that, unlike our other pollutants, ozone in fact is a pollutant that is formed by a photochemical reaction. We have volatile organic compounds or hydrocarbons that are given off by sources, such as automobiles or factories or small stationary sources. We have nitrogen oxides that are given off by large stationary sources or automobiles. They combine in a photochemical reaction; in other words, a chemical reaction, a "cooking" reaction with the sun during the day, and during the day we see ozone formed. So where the pollutants are emitted is not necessarily where we have the ozone problem. Transport is a major issue to be discussed in the ozone equation. Also, how do we control the formation of volatile organic compounds, nitrogen oxide—how much of both do we control for ozone?

THE SCIENCE OF OZONE

CERTAINTY REQUIRES KNOWLEDGE OF:

AMOUNT OF EMISSIONS	AMBIENT AIR QUALITY
TYPE OF EMISSIONS	METEOROLOGY





Mr. THOMAS. This photochemical reaction and the transport issues associated with it is one of the most difficult problems we face and one of the reasons why we have run into the problems that we have with attainment.

The second major nonattainment issue we've got for criteria pollutants this year is carbon monoxide. Now, carbon monoxide presents a different health effect from ozone. Ozone is a pollutant that presents a health effect that is a breathing difficulty health effect. It affects lung capacity. Exceedences of our standards result in decreased lung capacity; in other words, breathing difficulty, particularly if you're exercising. It's not necessarily in people who have lung problems. It may affect healthy people as well. There is also some evidence that ozone exposure presents potential long-term lung damage and may result in increased infection as far as the lungs are concerned. That evidence comes from animal studies.

Carbon monoxide is a pollutant that affects people who have a propensity for heart problems, angina, and other heart diseases that are affected by carbon monoxide. So it's a different health effect, but again, it's a health effect. Our standard, we believe, is a standard that protects with a margin of safety as far as carbon monoxide is concerned. And as you can see, we have problems all across the country. Many of those problems are in the same areas that we have ozone problems.

Carbon monoxide, as far as source is concerned, is different from ozone in that the vast majority of sources for carbon monoxide are the mobile sources, whereas with ozone, those sources represent only a portion, probably a third of the problem. But as you control the source for one, the mobile source, you will get benefit in the other. So there is an interplay between these two, and that's why you also see an interplay as far as the locations are concerned for nonattainment.

Here you see the violations per year. We don't allow more than one violation per year of our standard. And as you can see, the violations per year go up very high, as many as 100 to 120 violations per year when you look at the 1983–1984 time frame.

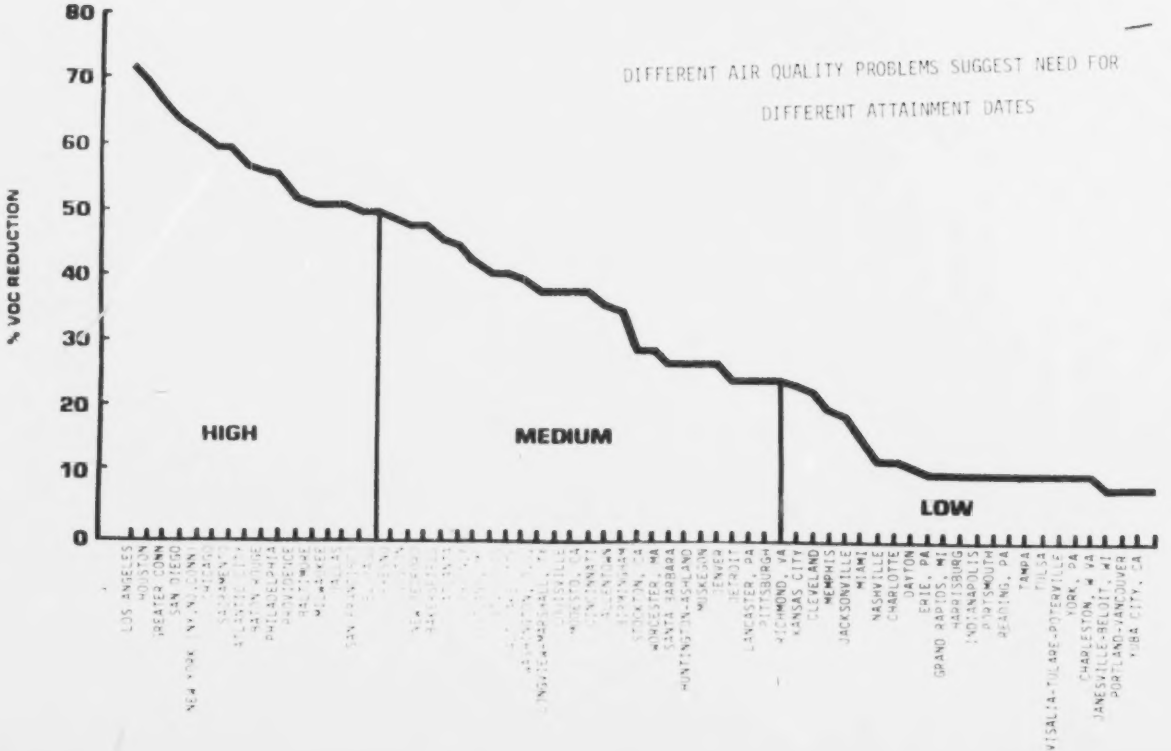
So ozone, carbon monoxide—even though over the last 15 years there have been major controls put in place across this country, and if you look at the trend line as far as emissions are concerned—you see a decline—we still have major problems as far as meeting the Clean Air Act's 1987 deadline.

Now, let me tell you what I think the three major issues are that, in a public policy sense, need to be debated on both of those pollutants. In my opinion, modifications need to be made to the Clean Air Act to deal with them; but short of that I'm dealing with them in the short term and am working through how, without Congress' revisions, I will deal with them administratively. I think we ought to parallel track, and the interaction that we're having in this committee is exactly the interaction that is necessary to talk about how we will deal with attaining these standards.

The first issue is the attainment date itself. These are the nearly 80 cities that are reflected on the first chart that are out of attainment; that is, that are having exceedences for ozone. They range from Los Angeles on the left over to Charles Town, West Virginia and others over on the right, from very high reductions in volatile

organics necessary to attain—Los Angeles, you're looking at 70 percent reductions, over to small reductions, 5, 6, 8 percent. These are only cities that are out of attainment. These are not those cities that may be just under the standard. But as you can see, we have very different problems as far as the reductions that are required. Los Angeles—it is not feasible to think that Los Angeles will come into attainment this year or within five years, but we do need to think about how fast and how much we want Los Angeles to do to meet this standard.

APPROXIMATE PERCENT REDUCTION NECESSARY FOR ATTAINMENT OF OZONE NAAQS

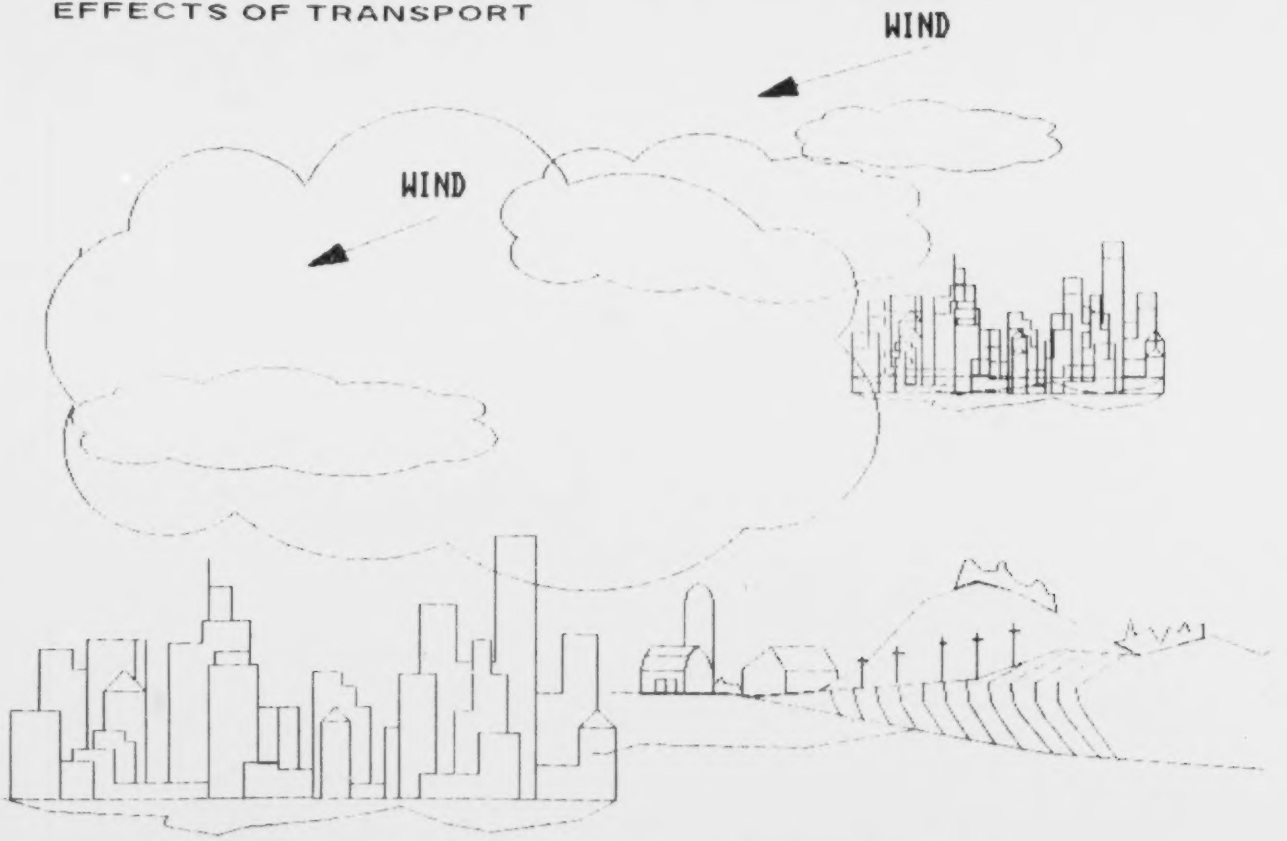


Mr. THOMAS. A major issue we've got to work through, I believe, is how far out do we push the attainment date. One, I think attainment dates are important. We need to have a fixed date for attainment in order to force the up-front planning at a State and local level about what measures will be taken and when to ultimately meet this standard. But I think the criteria for when we will set attainment dates need to take into account the very different problems we've got across the country. I think they need to take into account different air quality and meteorological issues, and I think we need to build in flexibility for the States for how far they are going to go in a time frame to meet this standard that is realistic and practical in the real world of controls for this pollutant.

So attainment dates, and how do we set them. In the short term, I'm enforcing the 1987 attainment date.

The second issue is transport. I mentioned transport. It presents us with a major problem with ozone, as I indicated. The one on the right is not a little city in the sky; that's a little city upwind, and as you can see in the morning in that little city we may have an ozone problem.

EFFECTS OF TRANSPORT



Mr. THOMAS. We've gotten volatile organics and nitrogen oxides that have been emitted in the early morning as people come to work. We've had a little cooking from the sun. We have a little ozone. Well, it blows on downwind. Not only does it present a problem as far as rural areas along the way, because we know that ozone presents a problem as far as crops are concerned. it retards crop growth; but it also then contributes to the next city along the way, which is cooking its own ozone. And particularly later in the day, as that whole chemical reaction has taken place in a more progressive fashion as it heats up, and it's largely a heating-up problem, a summer kind of problem that we have, that second city then gets a double dose. It gets its own ozone, and it gets the ozone that's blown from the upwind city. That's why in the Northeast Corridor we have such a problem.

What's coming from down around Richmond begins to work all the way up the coast, and we have contributions all the way up. So how do we deal with that? Well, we've tried to deal with it by broadening the nonattainment areas. The concept of attainment and nonattainment is an absolute basic part of the Clean Air Act. We've tried to deal with it by broadening the nonattainment areas; in other words, more controls in a wider range of places so that, in fact, we can deal with ozone. We've tried to deal with it by upgrading our modeling so that we have a model that takes into account an urban airshed. We're going to a regional airshed model.

But, in fact, I think a fundamental part of reauthorization of the Clean Air Act is going to be to give us flexibility to deal with the issue of transport, and I think we're going to have to take a different look at controls in attainment areas and nonattainment areas for ozone than we do for the other pollutants. We may well need to look at more of a generator-receptor concept when we think in terms of ozone and the kind of controls that may need to be applied.

The final issue that I present to you is the issue of sanctions. This chart, I think, reflects a simplified presentation of what the law tells me I should do as far as sanctions are concerned.

The two basic areas where sanctions are suggested are, one, where I disapprove a plan, and two, where I find nonimplementation of an existing plan. These are the plans that the States submit. I must tell you that there's a debate on that as well. The General Accounting Office has rendered an opinion to me that they think there's a further place where sanctions should be used, and that is where an area does not attain. In other words, where an area does not attain that standard by 1987, their view is that sanctions would be applied.

AREA	HIGHWAY	CONSTRUCTION	AIR GRANT	SEWER
		SANCTIONS UPON PLAN DISAPPROVAL		
EXTENSION (no Part D approval)	DISCRETIONARY 176(a)	MANDATORY 110(a)(2)(I)	DISCRETIONARY 176(a)	DISCRETIONARY 316
EXTENSION (prior conditional approval)	DISCRETIONARY 176(a)	MANDATORY 110(a)(2)(I)	DISCRETIONARY 176(a)	DISCRETIONARY 316
EXTENSION and NON - EXTENSION (prior Part D approvals)	ONLY THE NONIMPLEMENTATION SANCTIONS AVAILABLE TO ADDRESS PLANNING FAILURES			
		SANCTIONS UPON A (DISCRETIONARY) FINDING OF NONIMPLEMENTATION		
GENERALLY APPLICABLE	NOT AVAILABLE	MANDATORY 173(4)	ARGUABLY DISCRETIONARY 176(b)	DISCRETIONARY 316

Mr. THOMAS. My view is that if they have done all they could in planning to attain, if they've done all they could to implement that plan, and if they are continuing to do all they can, then sanctions should not apply. The sanctions should apply for planning diligence and implementation diligence, but I present to you that there is a debate on that. I'm sure it will be tested in the courts if Congress doesn't fix that issue. But my interpretation is what is submitted on this chart, and that is diligence to plan, diligence to implement. Where there is not diligence in planning—that is, an area that cannot submit a plan that shows attainment by the date in the law—I feel like I have no choice but to go forward and disapprove that plan. And when I do that, you will find there's no question but that construction bans will go in effect. That is, certain restrictions on the construction of new polluting sources, new stationary polluting sources. It's discretionary as to whether I use a cutoff of Federal highway funding, a cutoff of the air grant money we provide to States, and a cutoff of sewer grants. We have used all of those. We will use all of those. We will be proposing a series of sanctions for a number of cities in our normal course of business in the agency of managing this problem next month, which will be very traumatic for a number of cities and for us, but it is an ongoing process. The nonimplementation reviews that we're doing as a part of our ongoing review of States' efforts for implementation may result in proposed sanctions. Again, if we find nonimplementation, a mandatory construction ban. Possibly mandatory cutoff of the air grant, although I think that's arguable. I have suggested it should be—it is discretionary. Also, discretionary cutoff of the sewer ban. We don't have the highway fund cutoff available to us on nonimplementation.

But use of sanctions is something that I'm using in the agency. I've got cities that have got all of these sanctions against them, and they still won't implement the provisions of the Clean Air Act. A good example is Albuquerque. I have gone forward with a cutoff of a construction ban, gone forward with a cutoff of highway funding, air grant funding, sewer grant funding. Citizens of Albuquerque in a referendum voted down implementation of the inspection and maintenance program. I'm now looking at, do I go in and try to run an inspection and maintenance program in Albuquerque as a Federal initiative, which I think is the ultimate public policy debate on these issues, but an example of the kind of debate that we're having.

Sanctions, in my opinion, can have an impact. But in fact, I feel they need to be clarified in the law. I think we need to look at how we can use them more constructively than we've used them in the past, and I think we have to be sure that we've clearly defined when they will be used, far more clearly than in the existing law.

So in summary on ozone and carbon monoxide, Mr. Chairman, I think what we are in the midst of is a very healthy public policy debate. How far do we want to go? How fast do we want to go to attain what I consider standards that should be attained, health-based standards which were established under the Clean Air Act to protect health and the environment in this country, and we need to talk about how we're going to attain those standards.

We've made progress. Clearly, it's obvious that we have a way to go across this country. It is not an either/or proposition, either EPA does its thing or the State does its thing; it's both. It's not that EPA hasn't done its job; it's that it is a very difficult job for all of us to do together.

I would urge this committee to talk through what I consider major policy issues where clearly we receive conflicting signals, and clarify those signals in the law. Should EPA impose sanctions if reasonable efforts have been made? Or should EPA aggressively exercise its mandate to impose sanctions arbitrarily? In other words, if there's no attainment, drop as sanction as opposed to everything having been done that reasonably could be done. And how do you define "reasonable"? Should EPA stick to the Clean Air Act deadlines or should attainment dates be realistic? But 1987 is not realistic; 1992 is not realistic for some areas. How do we do that? Should EPA issue more RACT documents, Reasonably-Available Control Technology documents which are mandated for everybody to put that control on a stationary source, or should the States determine which sources they're going to control? A major issue of debate.

Due to transport, should EPA consider State-wide controls or should EPA limit controls to nonattainment areas? The issue of generator-receptor on ozone--how do we deal with that issue? Particularly, a debate that gets interposed with the issue of sanctions. Areas say yes, we need to expand our nonattainment area for controls, but no, if we're not going to make it we don't want it very large because we'll get sanctions.

So the last public policy debate intermixes with the issue of how do we use sanctions.

So in conclusion, Mr. Chairman, ozone and carbon monoxide are major issues, immediate issues which I feel need to be fully aired and debated. I laid out a position over a year ago in Minnesota. Again, from my point of view, it's a public policy debate, and I have had tremendous input from all sides on my suggestions. Many disagreed, many thought I was too weak, many thought I was too strict, many thought I was illegal. I had a good strong debate. It's begun on the House side and it's begun on the Senate side. It's an issue which I feel we need to conclude with modifications to the law. In the interim, I'll implement the existing law as it has been passed, as strongly and as aggressively as I can.

On the issue of acid rain, in conclusion, I welcome your input. I welcome the opportunity to clarify positions which you feel conflict. I don't, as far as policy is concerned. What is our policy? How is our policy changing? Is it different than the position I presented to this committee the last time we discussed this issue?

I welcome the opportunity to entertain now questions that you and members of the committee may have.

Senator MITCHELL. Well, thank you very much, Mr. Thomas, for your usual impressive and informative presentation.

Before we proceed to questioning, four other Senators have come in since you began. I will ask whether any of them wish to make an opening statement before we go to questioning.

Senator Lautenberg, do you care to make an opening statement?

OPENING STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator LAUTENBERG. If I may, briefly.

I, too, agree with the Chairman, Mr. Thomas. It's an impressive, coherent and very informative statement.

Mr. Chairman, I would like to commend you for holding this hearing today to address EPA's implementation of the Clean Air Act with particular focus on acid rain and ozone nonattainment. Both have been problems for my State, New Jersey. EPA has been conducting a national survey of surface water. The results of that survey have not been officially reported, but I understand it's going to indicate that a number of New Jersey streams are highly acidic. There were 25 streams in New Jersey that were randomly selected. Of the 25 surveyed, 10 were found to be acidic. The 10 streams were in New Jersey's Pine Barrens. The 10 streams have high sulfate concentrations. Sulfates are indicators that acid rain could be the cause of the acidity. These findings in New Jersey were high when compared to other regions surveyed. These findings indicate that our State may be at risk. Our forests, our streams, and the wildlife that depend on them may be very much in jeopardy. We've got to take action to stop this pervasive environmental threat. S. 321, which I join the Chairman in introducing, I believe would allow us to respond.

Another major problem for the Nation and New Jersey is ozone nonattainment, as we've heard. State officials believe it's unlikely that New Jersey is going to be able to meet that 1987 attainment deadline. In January, national and State environmental groups sued EPA and New Jersey over the ozone attainment question. We've heard testimony indicating the serious health effects of ozone, and we're seeing increasing evidence of acidity in our water.

Mr. Chairman, the time has come for action. I look forward to working with you and our other colleagues on the committee. I look forward to working with Mr. Thomas and EPA on that, as well. Thank you.

Senator MITCHELL. Thank you, Senator.

We're very fortunate to have with us today the distinguished former chairman of the committee. If I may just make a personal comment, last week we read with sadness that Senator Stafford has made a decision not to seek reelection to the Senate.

Senator, I think I can speak in behalf of all the members of this committee that we all consider ourselves fortunate to even have known you, let alone to work with you. I think it's fair to say that this committee was led for the past 6 years by one of the most decent, honorable, able public servants of our time, and your leadership resulted in dramatic improvements in the law in providing protection to the health and environment of Americans. Your retirement, while we wish you and your family the best, represents a real loss to this Nation, and we're very grateful to have had the opportunity to work with you. I think a round of applause is appropriate. [Applause.]

Senator CHAFEE. Mr. Chairman, I just want to say, before we hear from our distinguished former leader, that I don't think many people realize that Senator Stafford has been in full-time public life

since 1953. He has held practically every office that the citizens of Vermont can extend to one of their fellows. He has been Lieutenant Governor, Attorney General, Governor, served in the House of Representatives, and he's served 18 years here in the Senate, or will when he leaves.

I know he's embarrassed about these accolades, and we've got another year and a half to go on them, Bob, so you might as well get used to them. It will be like Sarah Bernhardt's farewell. The remarks will be well honed by the time we finish.

But anyway, I think it was so thoughtful of Senator Mitchell to lead this spontaneous tribute to you, and those of us on our side certainly want to join in it.

Senator MITCHELL. Well, Julius Erving just completed 23 retirement parties, Mr. Chairman, so you ought to get at least 24.

But I'll say this about Julius Erving, he was picking up free trips to Europe, Mercedes—I'm not sure we can match all those in your farewell appearance.

Senator STAFFORD. Well, Mr. Chairman, Senator Chafee, my colleagues on the committee, you really have taken me by surprise this morning. I deeply appreciate what's been said. It really has been a privilege to serve as chairman of this committee over the last 6 years. I've enjoyed every minute of it. I look forward to working hard with the members of this committee for at least the next 20 months before my term runs out.

I do have to say that leaving, when that time comes, is never an easy task for somebody who has been in this business as long as I have, or for anybody else, for that matter.

So thanks again for what you all said and for the privilege of being with you for 20 more months. And finally, a welcome to Lee Thomas, with whom we've struggled over the years as well as we could. Thank you very much.

Senator MITCHELL. Mr. Chairman, I want to say that one of the truly uplifting and mystical things about democracy is how individuals come to represent large numbers of people and possess the characteristics which are identified with large numbers of people. I think you perfectly embody the characteristics that many Americans think of when they think of Vermonters and New Englanders, really, and that is of genuine independence of judgment and granite-like integrity. And we're all very pleased that you're here.

We hate to move on to put Senator Graham in the spot of having to follow that; but, boy, you'd better have a good opening statement.

Senator GRAHAM. Mr. Chairman, exercising the good judgment of silence, I have no opening statement.

Senator MITCHELL. That's another New England-like quality.

Senator Durenberger, do you have an opening statement?

Senator DURENBERGER. Thank you, Mr. Chairman. I have no opening statement.

Senator MITCHELL. Well, we'll proceed to questioning now. In accordance with the committee's rules, the first round and all subsequent rounds will be limited to five minutes, and we will question in the order that the Senators appeared at the hearing.

Mr. Thomas, I thank you for your comments. I do want to go back to the question I asked in my opening statement, and let me rephrase and repeat it.

In 1980, the United States and Canada signed a memorandum of intent in which both countries committed themselves to developing and concluding as soon as possible a bilateral agreement to deal with transboundary pollution. Formal negotiations began in 1981. The Canadians pressed for 50 percent reductions of emissions on both sides. The United States Government, under this Administration, took the position that that was premature, and negotiations then terminated.

A few weeks ago, President Reagan stood before the Canadian Parliament and said that he would consider a treaty, which everyone assumed meant a treaty to reduce emissions as sought by the Canadians.

My question is, does that reflect a change in policy? As I said in my opening remarks, just a short time before the President spoke in Canada, you were quoted in the Wall Street Journal as telling Members of Congress that there may not need to be any reductions in emissions. I don't know whether you made the statement; I ask you if you did—but as I said earlier, I think the two propositions are mutually exclusive. I don't think this Administration can credibly offer the Canadians good faith consideration of reduced emissions and have a policy at home that says no emission reductions are necessary.

And so my question is—I hope the President's statement does represent a breakthrough as Mr. Mulroney claims, a change in attitude and policy, and I hope you're going to tell us that today. What is the policy? Are the statements inconsistent? Did you say what you were reported to have said? And if so, what did you mean?

Mr. THOMAS. Let me start with explaining what I said, and then let me talk about overall Administration policy as reflected by the President's statement.

First, yes, I said that. It was one of a number of things that I said. I was having a discussion with four or five Members of Congress who are interested in acid rain control legislation. And as a matter of fact, they were cosponsors of acid rain control legislation in the last Congress.

We were discussing the need for acid rain control legislation, the types of acid rain control legislation, and in this case we were talking about the status of science, what the science was telling us as far as what kind of control legislation may be necessary or what kind of controls may be necessary. And I was talking to them about a review of a study or an effort that I have had my scientists undertaking related to the latest information on aquatics effect, particularly the direct delayed responding systems in the northeast and in the southern Appalachians. And I indicated to them that the science, from what I was reviewing, was clearly incomplete. It was premature to try to draw conclusions. I was pushing my people very hard to try to draw conclusions, but we subjected their conclusions to peer review because we wanted to ensure there was as much integrity as possible when we drew conclusions, but that at a preliminary stage in the aquatics area, I was not seeing informa-

tion that would suggest the amount of reduction in sulphur dioxide in the time frame that they were suggesting, which was basically a 50 percent reduction in about 10 years; that I did not see information that would support that; and that as a matter of fact, the current science seemed to be indicating that, in the northeast—we were speaking of the northeast—there may well be a credible argument that we would not need any emission reductions beyond today's level of emissions to prevent further damage to lakes in the northeast, as one bound. And as an upper bound beyond that, we may need some reductions, but the reductions we needed were clearly not of the magnitude that they were suggesting in the time frame they were suggesting.

Now, my quote came from the front end of that: we may not need any additional emissions reduction beyond today's levels in order to prevent further damage to northeast lakes. It was one piece of that whole discussion. We had a long-ranging discussion on a number of issues, but to a certain extent that puts in context my discussion. It's not unlike the discussions that I've had with you and members of this committee in the past. Since I met with this committee in the past, I've spent a considerable amount of time with my scientists on the status of our research and other research, particularly in the aquatics area. I have been pushing, as I have constantly pushed, to try to get as much information as quickly as possible to determine whether policy should be changed. In this case, I feel the aquatics area is further along than any area as far as research on acid rain is concerned, and I feel like the pushing that I've done and the review that's been done by outside scientists for me over the last several months indicates clearly that we're going in the right direction with the right kind of research program to determine whether additional damage may occur; whether recovery may occur; what kinds of emissions reductions may be necessary, if any, in order to ensure that that happens as far as lake damage is concerned, particularly in the most difficult and complex area of determination, which is the direct delayed responding systems, which is what we have in many places.

So that was the context within which that whole discussion was taking place. Now——

Senator MITCHELL. Lee, could I interrupt you? Since the time is up on my first round of questions, out of courtesy to my colleagues perhaps, having completed that context, you could defer and when we get to me again you could pick up and take up on the President's statement.

Mr. THOMAS. Certainly.

Senator MITCHELL. I think in fairness to my colleagues I'd like to have you suspend at that point and resume later and give them a chance to ask some questions.

Mr. THOMAS. Sure.

Senator MITCHELL. Senator Burdick?

Senator BURDICK. Mr. Thomas, side-by-side comparisons of emission reductions by the United States and Canada are difficult because of differences in governmental forms and regulatory regimes. I understand that the eastern provinces of Canada, in an effort to reduce acid rain, have committed themselves to a 50 percent reduction in emissions by 1994. Do you understand that to be correct?

Mr. THOMAS. They have, Senator. They're in the process now of moving forward with implementation. That commitment was made a couple of years ago. They've still got a couple of provinces that have not yet implemented that commitment, but they're moving forward with that kind of commitment.

Senator BURDICK. I discovered something else recently, that as you move farther west in Canada through the provinces, that percentages go down. I understand that in Saskatchewan it isn't 50 percent, it's 25 percent, and it feathers out until you hit the Pacific coast. Is that correct?

Mr. THOMAS. Senator, let me say first, we are in the process of reviewing with Canada how they are implementing their control program. We are doing that because of our interest in learning more about how they're implementing it. We're also doing it in response to detailed questions we've received from the House Energy and Commerce Committee.

The Canadians have a different approach than we do. They don't have the strong Federal standard-setting authority that I have, for instance. That is largely an authority that the provinces have, so they work through an arrangement with the provinces to implement their standard-setting process. They don't have the 15-year reduction history we've got from strong Federal standards on sulphur dioxide, as an example.

Now, within that they also have different ways of looking at, what do you consider a violation? Is a violation the kind of violation that we've got, or do you accommodate violations by production cutbacks as far as plant operations are concerned? So is it an ambient violation close to the plant that we're controlling, or is it an overall loadings violation that may be controlled through a production cutback over a year's period of time?

Looking at those issues and working with the Canadians to find out more about how they control their emissions is one of the things we're doing right now. I must say, though, that the kind of commitment that the Canadians made two years ago, that they're working through to implement, I commend them for. My friend, Tom McMillan, who is the Environment Minister in Canada, and I have had numerous discussions about the difficulty of implementing that and the difficulty that we have in the United States of implementing our control programs, and we're working closely to understand exactly how each of us implements our laws.

Senator BURDICK. Well, I'm asking this question because, after all, this matter of air pollution is continental. It isn't only the United States; it's a continental matter. We are well aware that Canada doesn't have scrubbers on any of their powerplants. We understand that. They are trying to use clean coal technology and so forth, they talk about a 50 percent reduction, and as you go west they feather down to 25 percent and to nothing. I wonder if they're making a real effort, that's all.

Mr. THOMAS. There's a real question about that in a number of people's minds, and we're working that issue.

Senator BURDICK. What is your opinion? Should any acid rain bill that we enact after 1987 require scrubbers in the midwest in the future?

Mr. THOMAS. Senator, first, I don't feel we're at a point where acid rain legislation should be enacted by Congress. I do not feel like a requirement for emissions reductions beyond those that we have ongoing under the Clean Air Act is evident today that would require acid rain controls.

Given that position, if you decide to move forward with an acid rain control bill, I feel that legislation should be one that looks at an approach that builds in flexibility. It's aimed at total loadings reductions, but it builds in the most cost-effective way to go about getting that, which in many cases, I think, will result in not having scrubbers. But I think that it will allow—should allow—the States to clearly interplay with their utilities in determining how those total loadings should be reduced. It should include emissions trading. It should include flexibility in making that decision between coal switching, new clean coal technology, or scrubbers. I do not feel that those things should be mandated.

Senator BURDICK. You don't think the future bill after 1987 should require scrubbers?

Mr. THOMAS. No, sir, I don't. I don't think you should have a mandated scrubber technology.

Senator BURDICK. Aren't we slipping backwards a bit?

Mr. THOMAS. No, sir. Under new sources—the issue on acid rain is, are you going to mandate scrubbers on existing sources? All new sources in the United States, as you know, have scrubbers. We've got 150 of them with scrubbers now and 50 more on order, more than any other country in this world.

The issue is, are you going to go back and require retrofitting of your existing utilities? I don't think the concept of mandating retrofitting of scrubbers on existing utilities is the way to go at all.

Senator BURDICK. What do we do?

Mr. THOMAS. I think that if you decide to go forward, which I don't think you should do—if you decide to go forward and mandate additional reductions from those existing powerplants, I think you should build in the flexibility for the most cost-effective way to get those reductions, which includes the concept of switching fuels, the concept of new technology, the concept of scrubbers, the concept of conservation, all built in so that you have environmental and cost built in together in an effective way to get reductions in loadings.

Senator BURDICK. Well, I understand you, Mr. Thomas, but pardon me if I say it looks like we're retreating a bit if we're not going to be as firm as we have been in the past.

Mr. THOMAS. Retreating from what, Senator?

Senator BURDICK. Well, the requirement for scrubbers, for example.

Mr. THOMAS. But the requirement for scrubbers has always been on new sources.

Senator MITCHELL. Thank you, Senator Burdick.

Senator Chafee?

Senator CHAFEE. Thank you, Mr. Chairman.

Briefly—and I just want to get this quickly from you because I want to move on to something else—the problem we've got is that the new source performance standards obviously impose stiff requirements on new sources, so therefore what's happening in our

country is that we're not having new sources, that they are keeping the old plants going because there is less expense in so doing.

Many of us feel that we ought to be in a situation where we should be requiring the new source performance standards on the older plants because the theory was that the older plants eventually would expire, and then you would get new and more efficient plants—efficient as regards the release of pollutants. That's not happening.

What are you suggesting we ought to do? Why shouldn't we impose these new source performance standards on the old plants?

Mr. THOMAS. Well, first, Senator, I don't think you should impose them on the old plants because I don't think there's a scientific rationale for requiring that kind of emission reduction that you'd get from a new source performance standard, either as far as total loadings is concerned, as it relates to environmental damage, or the kind of specific definition that you would give to one location receiving damage from a particular plant. I don't think that there's a rationale for suggesting that you've got to have those new source standards on those old plants today or next year.

The problem you've got is as you stated. This country has decided not to go forward with the nuclear option, which was one we were pursuing aggressively a number of years ago. A lot of the new sources, as far as utilities were concerned, were nuclear at that point in time.

We also, now, are looking at how we can go forward and extend the life of our existing sources. We have found through technology development a number of ways to do that cost-effectively, repowering ways, retrofitting ways to extend those lifetimes. So in fact, we have to deal with, is that going to be an environmental issue for us or a public health issue? I don't think it's going to be a public health issue; there's debate on that. I don't think it's going to be an environmental issue; there's debate on that. I may change my mind on that, but today I don't think you've got the basis to go in and suggest that all of those old sources should put on very stringent control requirements that we impose on the new source performance standards.

Senator CHAFEE. Well, Mr. Thomas, what's the problem here? Is it your belief that the current emissions in the United States are not causing enough damage to cause you to enact stronger restrictions than currently exist? I mean, no one knows more about the damage that has taken place in Europe. You've seen it. You've seen the lakes in Sweden. You've seen the forests in Switzerland and West Germany, and, in your mind, you just are not convinced that that damage is taking place in the United States. Is that the problem?

Mr. THOMAS. That damage, connected with the emissions levels that we've got in the United States? That's correct.

Senator CHAFEE. You say that you've talked to your scientists and you haven't been persuaded. But the scientists are never going to give you the exact answer, and you know that. We've been around this track so many times together.

Mr. THOMAS. You're right. And I don't think on this issue they're ever going to give us an exact answer. But I will say, as I've said before, that I think that this issue is an extremely important issue

for a variety of reasons. Environmental is one set of reasons. Economic is another set of reasons. Social disruption is another set of reasons. This issue is one that today, I don't have to say, I've got to do this today with the scientific information that I've got today. I can say, over the next 2 years I will have much better scientific information to determine what I need to do and how much I need to do. If I thought today that I was facing a situation that I could not reverse, that I was facing a situation that was an ecological emergency, I'd act today on the scientific information I have today. I don't feel I'm at that point.

Senator CHAFEE. But what's going to happen in 2 years that's going to make this any different? You've sat here for four years——

Mr. THOMAS. On this issue, two and a half.

Senator CHAFEE. It seems like four, though, doesn't it?

Mr. THOMAS. It seems like 200.

Senator CHAFEE. Has this only been two and a half? And what's going to be different in two years? Why aren't we going to be right back here 2 years from now? And you're saying you just plain haven't got enough scientific information.

Mr. THOMAS. To do the kind of controls you want to do, to justify the kind of controls that you want to do, I haven't got that information today.

Senator CHAFEE. Why are you going to have it 2 years from now?

Mr. THOMAS. I'll have far better information. I'll have the results of the aquatics work that's underway. I'll have the results of the atmospheric source receptor work that's underway. I'll have far better results of the forest work that's underway in that two-year period of time.

Senator CHAFEE. And what you're saying to us is, don't do anything for 2 years. Hold back, because you have better information; is that your message to us today?

Mr. THOMAS. What I'm saying is that I don't think, given today's level of emissions, that we need to bring those emissions down based on the information I've got today. I will tell you, though, that I am constantly reviewing that position as a policy and scientific issue, and pushing very hard on the science. And that review is a constant thing with me. If I feel that in fact we need to suggest that emissions should come down, or that emissions should not grow, I'll state that as a policy position to you.

I personally am not comfortable with suggesting that emissions should grow.

Senator CHAFEE. Well, my time is up. Thank you, Mr. Chairman.

Senator MITCHELL. You said you're not comfortable with the suggestion that emissions should grow?

Mr. THOMAS. Increase from today's level.

Senator MITCHELL. Increase from today. That's not much, but it's something.

Senator CHAFEE. Well, I was going to say, none of us were even suggesting they grow. That wasn't before the house.

Senator MITCHELL. Senator Chafee's penetrating questions produced another victory.

The Administration opposes an increase in emissions.

Senator Stafford?

Senator STAFFORD. Thank you, Mr. Chairman.

Mr. Thomas, this is outside of the inquiry this morning, but it's a brief comment on my part.

The trade journals of the last few weeks are filled with reports that the industries which manufacture and use CFC's are pressuring you and the Administration to weaken your stand at the international negotiations.

We know of no more important environmental issue today than ozone depletion and global climate change. You've taken a position which we believe is entirely supported by the facts. Anything less is too weak and, we think, jeopardizes the future.

So let me say that I can think of no good reason for the United States to weaken its position one whit on this subject, and I salute the fact that you have taken a strong stand and I urge you in the strongest possible terms to maintain it.

Now to get to clean air. We started with the Clean Air Act of 1955. It's changed a lot since then because we've learned quite a lot. One lesson was that the States can't do the job on their own. When States try, they lose business to other States. New England can't halt the flow of acids from Ohio and West Virginia, nor does the law expect it. This is the role of the Federal Government. Nor can the middle Atlantic control the pollution in Virginia and the Carolinas which creates ozone. That is also the role of the Federal Government.

So the Congress put the Federal Government in charge, and specifically, the Administrator of the Environmental Protection Agency. The Administrator's job is to lead, to tell the States what they can do and what they should do. That's why the Agency's budget is measured in billions of dollars and thousands of people.

In the last 6 years there has been virtually no progress. Some levels of pollution have gone down; others have held steady. But almost all will increase in the future because this country has, we think, been coasting on the momentum built up by the Clean Air Act amendments of 1977 and earlier. Where those amendments were weaker than they should have been, progress has been slow or nonexistent. Acid rain is an example, and so is ozone nonattainment.

That's not to say that any of what might have gone before should be laid at your doorstep. But regardless of what happened in the past, there needs to be some assurance for the future. Therefore, I would appreciate knowing the following.

First, the Administrator has issued only five Control Guidance Documents in the last 6 years, and none in the last two. How many will be issued between now and January 1, 1989, and for what facilities?

Mr. THOMAS. Senator, the issue of control technology guidance and the reasonably available control technology requirement that is implied by them is a good one to discuss because it has to do with the debate that you've set up in the Clean Air Act of what the Federal Government should do and what the States should do in implementing provisions of that act. In trying to go forward and implement the provisions of the law, I think there's a balance between those things. There's a balance between what the States should do and what the Federal Government should do. I think the

Federal Government should provide an extensive amount of technical support, oversight, and also regulation.

As far as control technology guidance is concerned, the Federal Government has done that. We have 28 source categories with CTG's, which means that every State has to adopt those as far as their control plan for nonattainment areas are concerned. We've got 22 more source categories that we're looking at in determining whether we want to go forward with a CTG in each of them.

However, once we adopt a CTG it is a mandatory control requirement that has to go into every non-attainment area. Is it appropriate for a State to have to control a particular source which may be a very small contributor in that area, as opposed to another source which could be controlled far more effectively as far as reduction is concerned? Well, that's what a CTG issue is all about.

If I take all of those 22 CTG's that I'm looking at and wrap them up and put them out the door as a mandatory control, it will only get a four percent reduction in volatile organic compounds across this country. Will that help Los Angeles, which needs a 70 percent reduction? Will that help Atlanta? Will that help Chicago? A little bit. Well, could they do that without those CTG's? Not only could they, but they have. Look at what Los Angeles and California have already done. They've taken most of those 22 categories I'm talking about and moved forward to do them under State authority.

So where do I put my resources? On developing those 22 CTG's? Or do I put my resources on trying to provide technical support to the States and doing Federal regulation, like an enhanced inspection and maintenance program? Like a volatility regulation that, in fact, will have far greater impact, bigger bang for the buck? I can get, on a volatility regulation, eight percent reduction of volatile organic compounds across the country. Far more difficult to develop, very technical, but clearly a nationwide issue, clearly one that requires uniformity as far as the country is concerned.

That's the issue. It's not an issue of "if I do CTG's, I'm going to solve this problem" at all.

Senator STAFFORD. Thank you. I have some follow-up questions, but I'll await my next turn.

Senator MITCHELL. Thank you, Senator Stafford.

Senator Durenberger?

Senator DURENBERGER. Mr. Thomas, in case you're not around 2 years from now to report, I take the occasion to say that there are a lot of cabinet-level administrators that need five assistants sitting next to them, but you're not one of them. I thought your statement was incredibly responsive to our needs and reflective of the exchanges we've had over the last two and a half years on this and related subjects, and while I compliment all five of you, I wanted to compliment you in that way.

Mr. THOMAS. Thank you, Senator.

Senator DURENBERGER. Let me make the observation, as you were talking about that comment being taken out of context, how much I empathized with you. But you get in less trouble than some of the rest of us do. A couple of weeks ago I was at a breakfast the morning, I think it was, before the President's last press conference, and I was asked what the President ought to talk about at the press conference, and I said, "I don't think he ought to have a

press conference because all they're going to ask him about is Nicaragua and Iran and so forth," and then I said something like, "and he doesn't know what the hell's going on in Nicaragua because he never bothered to ask Ollie and Ollie never bothered to tell him."

Well, one of the reporters chose to take the front half of that, which was that he doesn't know blank going on, period.

And you can imagine the effect that had on my constituency, particularly the Republican one-third thereof.

I want to ask you this morning about section 112 of the Clean Air Act hazardous air pollutants particularly, but first let me ask you three related questions on the President's trip and what he told the Canadians. I understand that he promised them for the second time that we're going to do something about acid rain, and that in that context I have the impression that he was calling for a clean coal program as he said before he went there. I also have the impression that he specifically endorsed the report of the Joint Envoys on acid rain which was published in January, 1986.

If that's true, then let me ask you if you've had a chance to read or review the text of S. 911, introduced by the Chair of the subcommittee and by me, and whether or not that legislation isn't fully consistent with the report of the envoys. And then, the logical tie is that if the President supports the envoy's report and the bill incorporates their report, then does the Administration support our bill?

Mr. THOMAS. Senator, your characterization of what he committed to do is accurate. He has moved forward with full commitment in implementation of the envoy's report, including requesting the funding for the envoy's report recommendation over the last month. We are moving forward with the other components of it. As you know, we've had an ongoing clean coal technology program. This is a far bigger effort, and it's underway. We've got solicitations underway; Department of Energy is in the midst of setting up an advisory committee, and the Canadians are in the midst of designating who they would have sit on it. We have requested the funding of Congress.

I have reviewed generally the legislation you indicated. I can't tell you specifically whether I know that it's absolutely consistent. Generally, it appears to be, from my cursory review. I can't give you an Administration position on that bill, but I do know that the Administration has submitted a $2.5 billion authorization request, the immediate appropriation request for 1988, for the Clean Coal Technology Program, and has also indicated that the criteria in the envoy's report is the criteria that would be used

I also can tell you that our involvement in the clean coal technology effort—that is, EPA's involvement is one of both technical support and participation as far as the advisory process of what criteria should be set for selecting projects and which projects should be funded. So all of that, I think, is consistent with your suggestion and what's in the envoy's report.

Senator DURENBERGER. Let me get to section 112 of the Clean Air Act—the two major concerns that you've listed as we move into the amendment of the Clean Air Act are acid rain and ozone nonattainment. You've testified to that. I wonder if you wouldn't agree to amend that slightly to make it three major concerns and include air toxics on that list. As I look back over the legislation that's

been introduced over the last several years on Clean Air Act changes, it seems that the amendments that relate in one way or another to air toxics seem to dominate. Ozone is a fairly recent add-on, and acid rain has been around a long time.

Would you agree?

Mr. THOMAS. I agree that's the third area where there has been debate, and I think will be debate, as far as amending the Clean Air Act.

As I have looked at those three areas, I think there needs to be modification of the Clean Air Act on ozone and carbon monoxide to deal with those issues more effectively. On acid rain, I don't think there needs to be modification today. And on air toxics, I don't think there needs to be modification today for our ability to move forward to deal with the air toxics problems. I will tell you that there are some things, I think, if the Clean Air Act was modified in section 112, that I do believe could be incorporated that would facilitate our process, but I don't think there are major impediments in 112. I think they're things that can facilitate the process.

That toxics area is one we've spent a good bit of time on, worked hard on. The biggest debate on air toxics, as far as we are concerned, is probably twofold. One, there's a great debate about the timeliness of our setting of pollutant-by-pollutant standards. I can tell you that it is very difficult to cut down that time. We've done a number of things administratively which I find are beginning to work, and I think we're going to be able to cut down that without a need for changes in the law.

The other is the great debate between point source air toxic controls versus area sources. I believe we can get far more control by focusing on area sources like we did on wood stoves and others, but I don't think it's an either/or thing. I think you have to work on both. And I don't think we need modifications of the Clean Air Act in order to work on area sources. We're doing it under both new source standards as well as existing source standards.

But those are really the two areas of debate where I feel like we can respond to the issues under the existing act.

Senator DURENBERGER. Thank you.

Senator MITCHELL. Thank you very much, Senator Durenberger.

Mr. Thomas, would you continue, please, on the answer to my first question? I must say that it's deeply distressing to hear you say that you don't think there's any need for further emission reduction, but you're uncomfortable with increases. Doesn't that make the President's words in Canada meaningless? Doesn't it make it look just like what many, many people think it is, just a little rhetoric to make Mulroney feel good and to let Mulroney help himself politically?

Mr. THOMAS. No, not at all.

Senator MITCHELL. But what the Canadians want are emissions reductions.

Mr. THOMAS. I understand that.

Senator MITCHELL. And the President says, "We will consider that." If you assume good faith, you consider some effort to consider reductions. Yet you're sitting here, the Administration's principal spokesman, saying that there's no need for emissions reductions.

Mr. THOMAS. You asked me what my opinion was today as far as a need for emission reduction, and I gave you my opinion today. I will tell you that the President reviewed thoroughly our position in a number of sessions before we went to Canada, while we were in Canada, and we are reviewing those positions since we've come from Canada in view of the directions he has given us. That includes, before we went to Canada, fully reviewing and agreeing once again with implementing the envoys' report, which states clearly the differences between Canada and the United States. Clearly, we are moving to try to resolve those differences on science. We're working hard on that. We're ultimately trying to come to a conclusion on what kind of controls the United States may need to take vis-a-vis what Canada thinks we should take. We've established the kind of consultation process on all those issues that I think is important. We are moving forward with what we think is the major technology portion of the long-term answer to emissions reductions, which is clean coal technology for the long term, and we're moving forward on the science issues.

The President, in discussions with Prime Minister Mulroney, and in clear—I think—view of the Prime Minister's position of wanting more emission reductions today than the United States was prepared to commit to from 1980 levels, which is what he was suggesting, and we've had significant emission reductions since 1980 of sulphur dioxide—the Prime Minister indicated to the President that he felt that many of the things that we were doing—and in addition to the things we were doing, emission reduction things—should be incorporated in a bilateral accord like the accord we have on water quality in the Great Lakes.

They had extensive discussions about that. The President indicated to the Prime Minister that he would consider that, and he has directed us to consider that. We are in the process of beginning that consideration of that issue. That consideration will include what would be incorporated; what are the precedents for an accord; how would an accord be negotiated; what would an accord mean, and the substance of what would be incorporated in an accord, including the substance of the issue of reductions.

Can we reach agreement on that? Is it consistent with U.S. domestic policy? Can it be incorporated in an accord? Those are the very issues we're dealing with.

Senator MITCHELL. I have to say to you that the conclusion is inescapable; that what the President did was to add a couple of phrases to appease his friend, Prime Minister Mulroney, to enable Mr. Mulroney to claim some sort of victory in the summit for domestic political consumption in Canada. It has had zero effect on the policy of the United States, as evidence by your statements here today.

You've said you don't think there ought to be any emission reductions. You've now said, a couple more years of study. Lee, that would be fine if this were the first time we're hearing that. But 7 years we've been sitting here and asking the same question, two and a half of you and four and a half of your predecessor, and every single time without exception it's been the same answer: "We need to study more. We need to study more."

I just want to make one point and then I'm going to go to Senator Stafford. I'll come back and you'll have as much time as you need to respond.

You talk about acid rain as an issue. You've used that phrase several times, and you've said twice that the President wholeheartedly is committed to the envoys' report. Well, the envoys' report says,

> Acid rain is a serious environmental problem in both the United States and Canada. Acidic emissions transported through the atmosphere undoubtedly are contributing to the acidification of sensitive areas in both countries."

That's a specific conclusion of the report which the President of the United States endorsed over a year ago, and today you're telling us that you're beginning to consider the possibility of an agreement, and I just think we can reach no conclusion other than that this is just more of the same, and it will be truly remarkable—truly remarkable—if Prime Minister Mulroney can sell this in Canada as a breakthrough, given the Administration's position.

I'll go to Senator Stafford and when we come back you can take as much time as you need to respond.

Senator Stafford?

Senator STAFFORD. Thank you, Mr. Chairman.

Mr. Thomas, as I have listened to you this morning on the issue of acid rain and your frequent reference to the scientific material available to you, I have to say that it seems to me there is a wide difference between the scientific evidence that we have heard in this committee, last year and even this year, and apparently the scientific evidence that you're acting on or speaking for the Administration on.

So I have to wonder, recognizing there is apparently a considerable difference, who are your scientists? Are they in-house scientists that you're relying on, or are they industry scientists?

Mr. THOMAS. Senator, the scientific review that I speak to is not necessarily the review that's being conducted by EPA scientists or by the scientists who are under contract to EPA to do that review. It's often information from other scientific review, international review. It's scientific review that's being done by States and by the academic community into these issues.

Our latest review in the aquatics area included sessions with both EPA personnel and outside personnel, primarily from the academic community, although from other agencies and the international community as far as that discussion is concerned

I do spend a lot of time talking with and looking at scientific issues on acid rain. I spend a lot of that time with people in my Agency and outside of my Agency. I must say, I can understand why you could draw a conclusion different than mine. A lot of it has to do with what information you read, what information you hear about, how much debate you have on that issue with the different scientists. It also just has to do with how much information you feel you need in order to draw your management conclusion. As I've said in the past, clearly you, Senator Mitchell, other members of the committee have drawn conclusions that I haven't been able to draw. I don't debate your ability to do that nor your sincerity in doing that.

Senator MITCHELL. Mr. Thomas, thinking philosophically just for a second, we did start trying to clean up our atmosphere back in 1950. And in my judgment, for about 15 years we relied principally on the States to do the job. This was 1955 until 1970. And in my observation, during that time period we failed. That's why in 1970 we started changing the Clean Air Act and President Nixon created EPA to carry on the job. And in creating EPA, we made the Environmental Protection Agency the managing partner for the States and made the Federal role, we believe, a principal one in trying to control atmospheric contamination in this country.

So it seems to me that if we are ever to succeed fully in controlling atmospheric contamination in this country, along with the problems we have in other areas like water, that the Federal Government has to play the principal role. Streams know no State boundaries; atmosphere knows no State boundaries or international boundaries. So the Federal Government, we believe, has to play the principal role, and to say that the States can do it is simply ignoring the fact that for 30 years the States have been unable to do it. And that's a rather strong position that I feel.

Mr. THOMAS. Senator, I have come to know that issue now over the last 4 years, and I'd take this opportunity to commend you for the leadership that you've played and that other members in this body played 15 years ago when the Clean Air Act was adopted. I happen to agree with you, particularly on air. I think that it is an issue that requires strong Federal leadership and standard-setting. It also is an issue that requires strong State leadership on implementation.

Combining those two things, clearly the tug and pull you put into the Clean Air Act is what I manage. It's the process of how much Federal Government standard-setting do we need, and implementation. How much State government implementation and management do we need? Clearly on air, because of the unboundary condition of our atmosphere, our State boundary condition, we need more Federal. And you can see that through the things that EPA has done.

I thank you and we can look at the Clean Air Act as a success story in this country, a tremendous success story. It's not to say we don't have a lot more work to do, but look at the progress we've made. Look at the kind of improvements we've had, and I think it's a success. Clearly, we've got a struggle to go on. Clearly, the Federal Government is going to have to play a dominant role in that. Clearly, that's a major issue for debate between how much of a role we have and how much we prevail in that struggle.

Senator MITCHELL. Thank you, Mr. Chairman.

Lee, before I go to the next question, do you care to make a comment in response to my last comment? I want to make sure you have full opportunity to be heard.

Mr. THOMAS. I would like to. I'd like to tell you how strongly I disagree with your statement.

We thoroughly reviewed with the President our policy position on acid rain before we went to Canada. I was there and saw the extent of discussion that he and the Prime Minister had. I know for a fact how the issue was discussed about consideration of a bilateral accord and the full implications of what that meant, and I

know for a fact that that included full consideration of, did that mean modification as far as policy is concerned? Clearly, it meant modification of policy. Clearly, we had never suggested that we want to go forward and consider establishing a bilateral accord with Canada in this area. The President indicated he wanted to do that, and we are now in the process of doing that. Clearly, that is a major issue between our two countries, and the President decided he wanted to go the next step in determining how to deal with that issue.

Senator MITCHELL. Did you recommend to the President that he make that statement before the Canadian Parliament?

Mr. THOMAS. Senator, I did not.

Senator MITCHELL. Did you recommend that he not make that statement?

Mr. THOMAS. I did.

Senator MITCHELL. And did other of the President's advisers recommend that he not make the statement?

Mr. THOMAS. There was lively discussion about that.

There was a good deal of give and take on it. He made the decision. He decided he wanted to go forward in that direction. I think there are pros and cons to it. I think with the full consideration that was given to it, in retrospect, I would now recommend that he make that statement.

Senator MITCHELL. When you advised that he not make the statement, were you concerned about the possible inconsistency between that statement and not changing policy at home with respect to emissions?

Mr. THOMAS. Frankly, at that point in time I was more concerned about my full knowledge of what would be incorporated into an accord, what that would mean. Prime Minister Mulroney initially used the term, "treaty." I had reservations about what that would mean, how we would go forward with that, what was fully incorporated into that. I had less concerns about that when we began to talk about an accord—I'm speaking of the legality of that, the process of negotiating, the process of how we would move to conclusion on something like that.

So it was more of a—it was not an inconsistency with policy because I think when you consider an accord, you have to consider your policy as a part of that accord. So it was not that. It was not the ability for us to modify our policy. We have constantly said that we review that policy; we may need to modify that policy; we have modified it in the past. We may modify it again, so it was not that provision or that position of inconsistency because I did not feel it was inconsistent.

Senator MITCHELL. I really feel that you could claim victory here, that you could say that you've pursued a prudent policy of research for 7 years, and that the research has come in and justifies taking action. It is not a coincidence that your statement you say that in 2 years you'll know enough whether to do something, coincides with the expiration of the current Administration.

Mr. THOMAS. But that's not what I said.

Senator MITCHELL. It isn't? Oh, I'm sorry, then. I misunderstood you.

Mr. THOMAS. What I said was that over the next 2 years we will have far more information than we've got today that I think will be very good information in making decisions on controls. That's not to say you can't make decisions today.

Senator MITCHELL. Well, that's very encouraging. And of course, that's the position that we've been taking for some time, that is that while there remain some unanswered questions, there is enough information available now to make clear that the risks of inaction are higher than the risks of action. I suppose it's a subjective judgment for each person as to when you cross that line, but we hope very much that your comment indicates that you may be close to that now.

Mr. THOMAS. Senator, I think that characterizes exactly the issue.

Senator MITCHELL. Well, that's fine. That's encouraging. We've had somewhat of a confrontational situation with respect to this problem, and I really had hoped, coming into today, that that period might be over and that we could work with Administration cooperation in this regard. Perhaps that's still possible. I will assure you that for myself, as chairman of the subcommittee, and I believe many members of the committee, we are determined to proceed with acid rain legislation this year. As you know, twice the committee has approved it and twice we have been unable to get a vote on the Senate floor. Formidable obstacles remain to that, but we are determined to press forward and we hope very much that you will be joining with us in participating, at least to provide us with your counsel and guidance even if you don't agree with us. We've done that before, in the past, and you've been very forthcoming, and I hope that that will be the case this year.

Mr. THOMAS. Senator, I'd like to do that. As we've done in the past, I feel like we should always, if possible, work with the committee and committee staff to talk about implementation issues associated with any legislation that Congress is considering.

I must tell you that in this area, it easily falls back into, well, do you think something should be done or not? I think we can work through that issue, and we would like to work with you. I can tell you in that regard, though, that there are major concerns with the kind of approach that you're suggesting in the bill that you have offered, as with the bill that Senator Stafford has offered. I have presented some of those comments in the past, but I think that there are many reasons from my point of view that even if I crossed the line and suggested that something should be done, that I wouldn't suggest anything like you're suggesting.

Senator MITCHELL. Well, although your answer to Senator Burdick's question about scrubbers was a ringing endorsement of that aspect of my bill——

Mr. THOMAS. Which aspect?

Senator MITCHELL. The need for flexibility in the approach that we're talking about.

But my time's up, and we will go to Senator Stafford for another round.

Senator STAFFORD. Thank you, Mr. Chairman.

Mr. Thomas, the Administrator has yet to promulgate regulations completely eliminating lead from gasoline, and I suppose

there is some significance to my interest in January 1st, 1989. Do you expect that by that time you will have done so?

Mr. THOMAS. I don't know, Senator. We have made tremendous progress over the past 2 years in phasing out lead in gasoline. We've seen that already in our ambient standard results, on our trends report. We're going through now a full implementation review of how that's being managed. Because of the banking provisions that we incorporated in that, it will be another year or so before we are fully down to that 0.1 grams of lead per gallon of leaded gasoline that we established.

As to whether we go below that or not, I think there are major considerations that we've got to complete our review on. For instance, we're just completing our review of the impact of nonleaded gasoline on heavy equipment, particularly farm equipment. At the direction of Congress and at my direction, my staff and the Department of Agriculture staff have done an extensive study on that which we'll be releasing in the next couple of days.

There are real concerns about the impact of no lead in gasoline on heavy equipment that's under stress, like farm equipment. The availability of additives for gasoline that could be used in lieu of lead for protecting valve seats is one of the things we're working hard on.

I think that issue has got to be worked through, as well as health-related issues that are contributing factors to that .1 grams lead in leaded gasoline so that we can make a more informed judgment, and I think that is going to take us a considerable amount of time. I had proposed that by next year we would be able to make that judgment, namely, by the first of 1988. I don't see any way that that judgment's going to be made in that kind of time frame. I think that we want to see how the marketplace reacts to the full phase-down we've got underway now. We want to look at the results of this farm study which have some definite, real problems associated with complete phase-out, and we want to look at the results of our health studies and contributions of this last little remaining bit of lead before we draw final conclusions.

Senator STAFFORD. You have yet to adopt either Phase 2 or on-board controls for gasoline vapors. By what date do you believe that might happen?

Mr. THOMAS. I hesitate to predict a date, since I've done that several times over the last two years. Each time I've missed it; now, I've missed it by a good year from the last time I projected it.

It is in final review in my Agency, both the issue of whether to require, through Federal regulations, Stage 2 or on-board controls, and Federal regulation on gasoline volatility. I intend to propose regulations on both of those. I'm hopeful I can do that in the next couple of months. I've been saying "the next couple of months" for the last several months. It has been a difficult issue technically, but I feel that I'm at the final stage of that in my agency. So hopefully I'll have those proposals out soon.

I will say that the Agency made a decision on the on-board Stage 2 issue early in the Administration. The volatility issue is an issue which has really arisen during the last three years because of the excess volatility that we've seen in gasoline during that period of time. But hopefully, we're right near the end of the process.

Senator STAFFORD. All right.

Finally, the coming crisis in nonattainment has been on the horizon for a long time, some would say years. Yet, EPA is only now beginning to take action. States have not been given the guidance they need. Plans have not been affirmatively disapproved when they should have, and the Congress has yet to receive a firm, clear statement of the Administration's position. Why have none of these things happened, even at this late date?

Mr. THOMAS. Senator, I sure don't agree with you on that. This has been an issue that has been a struggle for our agency and a struggle for the States for the last 10 years. We've gone through calling in State implementation plans from States, implementing those plans. We've gone through calling in new State implementation from States that we don't think are going to attain, like the 1984 calls from about 20 areas. We've clearly made it plain that we think we've got a major problem on this. I began a big discussion of it publicly about a year and a half ago. We've implemented sanctions in areas. We've gone forward with the most stringent mobile source control program in the world. We've gone forward with stationary source controls. We have Federal requirements on 28 source categories.

I think EPA has worked like the devil on this issue. I think the States have, too, but it is a tough issue and it is not one that's going to be your fault or my fault. It's one that we're going to have to, I think, get better clarification in the law, and I'm going to do it in policy if I don't get it in the law, as to how we're going to attain in the future.

I don't think we should stray from our goal, which is attainment of these standards. I just think it's tougher to do than we thought it was going to be in 1977 or in 1982 or in 1985 or in 1986.

Senator STAFFORD. Well, thank you, Lee.

Mr. Chairman, I hope we can work together with Mr. Thomas as we have in the past. As you've pointed out, he's been very helpful with the committee, and his senior people have been, also. I don't think we will accomplish much with confrontation between this committee and EPA. I think that if we're to make progress, we have to find ways to work together.

I do have some additional questions but I'll submit them in writing.

Senator MITCHELL. Well, Mr. Chairman, as I've noted before with respect to Mr. Thomas, as an old trial lawyer, anybody can try a good case. It takes a real skillful lawyer to argue a weak case, and Mr. Thomas, you've demonstrated your extraordinary skill in that regard here today on the acid rain subject.

On that, Lee, if you can stay for about 10 more minutes we'll quit at 11:30. Is that all right with you, Mr. Chairman?

Senator STAFFORD. Yes.

Senator MITCHELL. We had a hearing here on February 3d. I know you're very busy, but I would hope, if you haven't done so, you would ask your staff to at least excerpt for you some of the testimony we had.

Mr. THOMAS. Which one was that?

Senator MITCHELL. That was on the health effects of acid rain.

Mr. THOMAS. I have looked through some of that testimony.

Senator MITCHELL. It was a very significant hearing. We had four physicians: the President-Elect of the American Academy of Pediatrics, the President-Elect of the American Lung Association, the Past President of the American Public Health Association, and the Director of Environmental and Occupational Medicine at Mount Sinai Medical Center.

They unanimously recommended to this committee that in their professional opinion, based upon their experience, that health considerations now represent a sufficient basis to justify legislation to control emissions of sulphur dioxide and nitrogen oxides. Heretofore, the debate has focused on surface waters primarily, and possible damage to forests. I know that you are as concerned as any one of us about the health of the American people, and that is an additional dimension.

Is the EPA now conducting any research on the health effects of acid rain?

Mr. THOMAS. Senator, you raise a very important point. When I look at the issues associated with sulphur dioxide and nitrogen oxide, I actually spend a good portion of my time on health issues because the primary standards that we set are based on health effects, and secondary standards on welfare effects. In this case on sulphur dioxide, I've spent an awful lot of time on welfare effects, meaning acid rain lake and forest damage, because of the debate, because of our concern, because of the problem we think is there. But I have spent a tremendous amount of time on health effects, particularly as it relates to sulphur dioxide, particularly as it relates to our existing standard—whether, in fact, we should have a tighter primary standard for sulphur dioxide, the so-called "one hour standard."

So I have reviewed and spent long periods of time, both with my health experts as well as outside agency health experts, on the concerns of sulphur as far as health is concerned. Out of that has come an awareness that there's a growing body of opinion in the medical community that the kind of health effects that we have seen near sources, polluting sources of sulphur dioxide, may not be the only health issue that we should be concerned about as far as sulphur dioxide. The issue of acid aerosols, which are very fine acidic particles, may also be an issue that we should be concerned about.

My Clean Air Science Advisory Committee, which is the peer review committee established at EPA that reviews all of our health standards, suggested that same thing to me as they reviewed our particulate matter standard, which is a part of this issue, as well as our sulphur dioxide standard, which is a part of this issue. We have a review underway now in the agency of the issue of acid aerosols, and are preparing a health criteria document. We are in the process of scheduling a workshop with our Clean Air Science Advisory Committee that will be an open workshop to review this issue.

We are collaborating with other agencies as far as epidemiological reviews concerning this issue of fine particle acid aerosols and their health effect, and when I think in terms of total loadings of sulphur dioxide in the atmosphere, I think in terms of what are the environmental effects, meaning acid rain. I think in terms of what are the health effects. I think in terms of what may be the

environmental effects or welfare effects like visibility. All of those things are important ingredients in my determinations under the Clean Air Act as to how we should deal with them.

In the last two years I would say that the issue of acid aerosols is one that, from a medical point of view, has grown as an issue of concern, and EPA is paying close attention to it.

Senator MITCHELL. You recently promulgated a tall stacks policy. The Natural Resources Defense Council proposed a different policy, which you did not accept. Do you agree that had their proposal been adopted, greater emissions reductions would have been achieved than under the regulations you've put in place?

Mr. THOMAS. Senator, actually, it was a regulation about a year ago. The tall stacks regulation has gone through two or three legislative changes and three or four judicial changes. I was implementing a court-imposed interpretation of the tall stacks portions of the law and went forward with the regulation. We are now implementing that regulation with the States. It's a traumatic process. You've got some States that are having to go in and look at shutting down power plants. We're talking about a good many jobs in some places. It will get reductions, as far as sulphur dioxide is concerned.

Clearly, if I had taken the position that NRDC had suggested—and I had discussion with them about that position—there would have been more reductions because they had an interpretation that would have required scrubber controls before I even looked at the height of the stack. I didn't think that was consistent with the law, clearly not consistent with the court opinion I had, and so I went forward with a different interpretation.

We are now working through that. We are implementing that. I must tell you, as usual, I'm being litigated from all sides and the bottom as far as that one is concerned.

Senator MITCHELL. Well, I have several more similar questions which I'll defer. My time is up on this round. I'm going to have to leave to go to another meeting, do you have some other questions, Senator Burdick?

Senator BURDICK. Yes, I have just one question.

Senator STAFFORD. I have one.

Senator BURDICK. All right, why don't you proceed?

Senator STAFFORD. Well, you were next in line.

Senator BURDICK. All right.

Mr. Thomas, preliminary studies indicate that large amounts of acidic sulfates and nitrates are produced in cumulus clouds. Cumulus clouds may be very important in the formation of acid precipitation. Detailed analysis and measurement of these aerosols is currently lacking.

Over the last several years, the University of North Dakota has utilized tracer techniques to follow air motions in cumulus clouds. Is EPA currently conducting similar research?

Mr. THOMAS. The issue of formation of acid aerosols and acid sulfates in cumulus clouds is a major issue under the acid rain research program, our cloud chemistry program, our cloud monitoring program. All are important parts of that, as are tracer studies.

We think it is an important element to be taken into account in looking at acid rain, particularly at high elevations, particularly as far as the nitrogen contributions. I am generally familiar with the

University of North Dakota capabilities and interest in this area, and we're interested in discussing it further with them. As a matter of fact, we've got a meeting set up for next week to talk with them about the kind of work that they can do and how to tie that into our overall acid rain program.

Senator BURDICK. Then you agree that their type of research, to have it available would be helpful?

Mr. THOMAS. Clearly, that kind of research is an important part of acid rain research.

Senator BURDICK. Thank you very much, Mr. Chairman.

Senator MITCHELL. Mr. Chairman, could I just ask one more question of him before I have to go?

You recently submitted a proposal to OMB of on-board vapor recovery regulations. Is that correct?

Mr. THOMAS. Well, we're in the midst of our review on a proposed regulation, and your statement is correct. It is a part of our final review process. It is under review in my Agency and that Agency, consistent with the way we review all of our regulations.

Senator MITCHELL. Could you provide us with a copy of that?

Mr. THOMAS. I don't want to provide you with a copy of that. It has to do with the position we take on our internal review of the regulation within the Executive Branch before it is proposed.

Senator MITCHELL. Don't go any further. Let me just tell you, this is one of the things that disturbs me. Here's a copy that we got from a lobbyist.

Mr. THOMAS. I was going to say, before you stopped me, that I understand there are a number of them on the street.

Senator MITCHELL. It's kind of disturbing, really.

Mr. THOMAS. It disturbs me too, Senator.

Senator MITCHELL. If you have legitimate reasons for maintaining internal control over the document, that you don't want to give it to this committee or anybody else, that's fine, but——

Mr. THOMAS. I have the exact same reaction you do.

Senator MITCHELL. Yes.

All right. Well, thank you very much, anyway. I go now to Senator Durenberger or Senator Stafford.

Thank you, Mr. Thomas.

Mr. THOMAS. Yes, sir.

Senator STAFFORD. Mr. Thomas, I am just going to state this question for you. If you wish, you may answer it in writing, but I wanted to ask the question here.

In April, 1981, EPA published in the Federal Register a list of proposed actions to lighten the "regulatory burden" on the motor vehicle industry. The notice contained an estimate of a cost saving to the industry and the consumer, but did not estimate the effect of the proposal on emissions or air quality.

I'd like to ask you first which, if any, of the following relaxations of regulations are still in effect; and second, if you will supply for the record the estimated difference in emissions between the revised regulations and emissions if the original regulations had been left in effect.

First, regulation of the statutory HC and CO standards for heavy duty trucks to a level that does not require use of catalysts.

Second, relaxation of the 10 percent acceptable quality level to 40 percent for assembly line testing of light and heavy duty trucks.

Third, institution of emission average for NO_x from light and heavy duty trucks.

Fourth, institution of emission averaging for diesel particulate emissions.

And finally, reductions in the annual number of assembly line test orders. If that could be supplied to us for the record, that would be satisfactory.

Mr. THOMAS. I would be glad to provide that for the record.

[The information requested follows:]

RESPONSE TO SENATOR STAFFORD'S QUESTIONS

Regulation of HC and CO Standards for Heavy-Duty Trucks

Catalyst based standards were originally promulgated in December, 1979, for 1984 and later model year heavy-duty gasoline trucks. In response to the sales depression and economic problems experienced by heavy-duty truck manufacturers in the early 1980's, EPA granted relief in rulemaking published on November 16, 1983 (48 FR 52170). However, for most heavy-duty gasoline trucks, the requirement to comply with catalyst-based standards was merely delayed until the 1987 model year. Only the heaviest gasoline trucks (mostly over 14,000 pounds gross vehicle weight) are still exempt from stringent emission standards, and these trucks are gradually being replaced by diesel trucks. Our latest information shows that less than 100,000 gasoline trucks are being sold each year that are exempt from catalyst-based standards. By comparison, this is only six to seven percent of the total number of heavy-duty trucks (as classified by the Clean Air Act) sold each year.

The promulgated changes to the heavy-duty truck standards will reduce total non-methane HC emissions from all sources by 1.3 to 1.5 percent during the 1990's. Similarly, total CO emissions will be reduced by 17 to 18 percent. Had the original rule been left in place, additional HC and CO reductions would be insignificant.

Emission Averaging for NO_x from Light- and Heavy-Duty Trucks

There is no evidence that the truck emission averaging provisions have an adverse environmental effect. "Averaging" is an optional methodology which allows manufacturers more flexibility in meeting the emission standards. If a manufacturer chooses to use the averaging methodology to certify some vehicles to a less stringent standard, other vehicles within its product line must be certified to correspondingly more stringent standards. On a sales-weighted basis, the manufacturer's product must meet the same overall emission levels, thus assuring no adverse effect on the environment.

Emission Averaging for Diesel Particulate Emissions

As explained above, the allowance of averaging within the basic compliance process should not have an adverse effect on the environment. In the case of heavy-duty trucks, the averaging concept was promulgated in conjunction with more stringent particulate emission standards.

In the case of light-duty vehicles and light-duty trucks, EPA originally proposed in 1980 more stringent particulate standards of 0.2 gram/mile (gpm) and 0.26 gpm, respectively. These were delayed in 1984 due to technical feasibility considerations. However, those standards were eventually promulgated and became effective in the 1987 model year at which time emission averaging was also permitted.

Relaxation of Acceptable Quality Level and Assembly Line Test Orders

The actions to reduce the regulatory burden on the motor vehicle industry included reductions in the annual number of assembly-line test orders and the relaxation of the 10 percent Acceptable Quality Level (AQL) to 40 percent for assembly-line testing of light-duty trucks (LDTs) and heavy-duty engines (HDEs). The 40 percent AQL has been in effect for passenger cars since the assembly-line test program began in 1977. In 1980, we set the AQL at 10 percent for light and heavy trucks. However, because of financial difficulties in the motor vehicle industry, we relaxed in 1983 the AQL for trucks to 40 percent. That level remains in effect without significant adverse environmental impact.

EPA issued 39 Selective Enforcement Audit (SEA) assembly-line test orders for light-duty vehicles (LDVs) and LDTs in the 1980 model year. EPA issued 28 SEA test orders in the 1981 model year, and by the 1983 model year the number was decreased to 17. Although the number of assembly-line audits has decreased, the number of vehicles tested by manufacturers under their voluntary self-auditing programs has remained relatively constant at approximately 20,000 tests per year. In addition, there has been no increase in the rate of assembly-line audit failures as a result of reducing the annual number of car or light-truck SEA test orders. In the 1986 model year, EPA implemented the HDE SEA program, conducting four audits of heavy duty engine manufacturers.

Mr. THOMAS. If you'd like, Mr. Wilson could probably respond to that now.

Senator STAFFORD. All right.

Mr. THOMAS. I'd also say, though, that in my tenure, my two years, I've gone forward with regulations on heavy duty trucks, both for NO_x control and particulate control for diesels, that are stringent standards, technology-forcing standards, all the way out to the mid-1990's that they have to meet.

Senator STAFFORD. If Mr. Wilson wants to respond further, we'd be glad to have him.

Mr. WILSON. Thanks, Senator.

As Mr. Thomas said, we do have stringent emission regulations for heavy duty gasoline trucks except for the heaviest ones that are gradually being replaced by diesel trucks, and those standards do require the use of catalysts, so that's no longer the case. With regard to the two averaging provisions, those still exist, although we found those to be changes that do not have an adverse effect environmentally; they are changes that allow our regulations to be implemented more efficiently by the industry.

The same with the SEA orders. We reduced the number of assembly line tests because the industry has now adopted a rather rigorous self-testing program itself at the assembly line, so we have found that we can maintain that same self-audit program on the part of the industry by still using less resources on the part of EPA, so we've found none of those to have an adverse environmental effect.

The AQL limit is a higher limit. It remains at—it's a test program of how we set the statistics on this assembly line testing. We do have it at 40 percent. Again, we've found that we can maintain a high quality of compliance at the assembly line with our certification standards with that assembly line program we have in place.

Senator STAFFORD. All right. Well, you've heard the question and I would appreciate a detailed response to it in writing.

Mr. WILSON. We'd be pleased to.

Senator STAFFORD. All right. Thank you.

Thank you, Mr. Chairman.

Senator BURDICK [assuming Chair]. The Senator from Minnesota?

Senator DURENBERGER. Thank you, Mr. Chairman.

Mr. Thomas, we left off with your characterizations of the section 112 implementation, and you said legitimate questions could be raised about timeliness on the listing program. I want to begin there, if I might, with some definition of your experience over the last two and a half years.

At your confirmation hearing Senator Stafford asked you a series of questions about air toxics. One thing he asked was whether you would reaffirm the commitment made by Bill Ruckleshaus to make listing decisions for 25 or so substances by the end of 1985. Your reply was,

> The commitment of former Administrator Ruckleshaus to make decisions on 20 to 25 potential air toxics by the end of 1985 remains one of the agency's highest priorities, and we believe that this commitment can still be met.

My question, did you meet that date?

Mr. THOMAS. We did, but it was not a commitment to list 25 substances. It was a commitment to determine whether we would list 25 substances. We met that commitment. We're going forward now to actually list. We've had an ongoing process. Once we make a decision, are we going to list a substance, then we go through the regulatory process of developing the control standards required and proposing those. We're doing that now. We have one, for instance, that will be proposed probably this week. It's been an ongoing process, but we did meet that commitment.

Senator DURENBERGER. Have you, during your time as Administrator of the agency, committed sufficient financial resources or human resources to the air toxics program? Particularly, has the budget for section 112 implementation gone up under your administration?

Mr. THOMAS. Actually, I've increased the resources, both people and dollars, for air toxics significantly during my two years in both aspects; that is air toxics as it relates to chronic effects, as well as air toxics as it relates to acute effects. Particularly now that we've got the acute effects provisions of the Community Right To Know-Superfund law, additional resources will be going into that portion of the program.

But yes, the resources have gone up significantly.

Senator DURENBERGER. One of the internal EPA documents that float throughout this committee is called "Options for Accelerating the NESHAP Development." This one is dated February, 1986. Are you familiar with this document?

Mr. THOMAS. I actually had a session with my staff on options. I don't know the exact document. It's probably the one I have.

Senator DURENBERGER. What it does is show that it takes on the average of 10 years to set a toxic air standard. I'm not going to try to go through all of the details, but what the options paper indicates is that the review by the Assistant Administrator for Air has taken up to 24 months. The OMB review takes about 18 months, and this document, dated February, 1986, makes some recommendations for speeding up that process.

So my question is, have you done anything to implement the recommendations in that document to speed up the process? Do you think that 10 years or 7 years after all the data is in is a reasonable time to issue a standard?

Mr. THOMAS. No, I don't think that's a reasonable time frame. I directed the staff to do that kind of review because I wasn't satisfied with the process that I found for dealing with air toxics. I felt that it needed to be moved, and I felt that there had to be ways

under the existing law to move it more expeditiously, given the experience that I had had in the agency under other regulations.

We have found ways, and we are moving. We've got a major regulatory effort underway on hazardous organic compounds now which combine in one overall proposed regulation about 8 pollutants and 13 source categories. It was a new way of looking at how we could use information from our new source program and other source programs in the agency to move over and make decisions in the air toxics program.

So we have found ways. We're moving forward with it. We think we can shorten time frames. We also have taken those review time frames that you talked about and looked at shortening them considerably and putting in a different approach for dealing with air toxics than the heel-to-toe approach that was often used in the past.

Senator DURENBERGER. It would appear—this is not a critical question, other than in a constructive sense—it appears that you've been doing a lot of looking, but the bottom line on all of this is how many toxic air pollutants have actually been regulated. This reminds me of all the questions we went through on the Safe Drinking Water Act. The program has been in existence since 1970, which is 17 years, and at various times during that period the agency has listed from 37 to 184 air pollutants as being of concern. And yet, you have only set standards for seven.

Now, does that appear to be a reasonable record?

Mr. THOMAS. Well, first, Senator, you have to back up and talk about how you're dealing with toxic air pollutants and look at a range of authorities you've got to deal with toxic air pollutants. Section 112 is only one. As a matter of fact, it may be the most inefficient section, both as far as public health reduction and time are concerned. Our new source standards deal with air toxics. Many volatile organic compounds that we control under our ambient standards are air toxics. We've gotten considerable reductions; as a matter of fact, probably our largest reductions of air toxics are under categories that are not 112 of the Clean Air Act.

We also have gotten considerable control as we've looked at area sources, the kind of wood stove regulation that I talked about, the fact that we're now moving to look at regulations on municipal waste-to-energy incinerators. We're coming close to regulations on treatment, storage and disposal facilities for hazardous waste, all regulations that don't necessarily come under Section 112.

So the pollutant-by-pollutant review of 112 is an important review process, I believe, to look at where we have a pollutant that is presenting an individual particularly high risk, and should we address it. But I have found that is not where we get our greatest reductions as far as air toxics are concerned, and it's a very difficult process to undertake. That's not to say we shouldn't do it. I've put more resources into doing it, and we are concluding that, but I think there are a lot of ways that we can get at our toxic reviews other than just a 112 way.

Senator DURENBERGER. Let me ask you now about the State referral program. You announced in June of 1985 that you would shift much of the responsibility for regulating air toxics to the

States, and I wonder if you would describe that proposal for us, the rationale behind it, and its popularity.

Mr. THOMAS. As I've stated about a thousand times since then, that wasn't what I announced. That clearly was what the newspapers indicated I announced, though, in many cases.

What I announced was that we were going forward with a more aggressive air toxics program, including additional resources into the Federal program, additional Federal standards, and also we were going to work to try to assist the States in developing a stronger State program, air toxics at the State level. It wasn't a primary concern in the early days. I think we put a lot of effort on ambient standards. And I said that I thought we needed to do both. I didn't think it was either/or, and I think the States need to take on additional responsibilities for parts of air toxics like they do other parts, whether it's monitoring, enforcement, or—in some cases—standard-setting. Where we haven't set a standard at a Federal level, they may want to, and we need to provide them the technical support to do that.

Actually, I have found that implementation of that has been very successful. The States clearly didn't want us to put the burden on them to deal with air toxics, and clearly, I wasn't trying to. So as far as the announcement that the newspapers carried, I had a number of States and some members of this committee who said, you know, Thomas is dumping on the States. Well, I wasn't; that wasn't what my interest was at all. The actual implementation of it, I found a number of States that said yes, we want the kind of information he has. We also want him to have a very strong Federal program. We'd also like for him to give us some more money. That's the one thing I haven't been able to do much about.

Senator DURENBERGER. Do you know how many toxic air problems have been effectively regulated by the States since you've been here, since 1985 and since this discussion has been ongoing?

Mr. THOMAS. I'll be glad to give you that for the record. I can tell you that I know, for instance, on acrylonitrile, which was one we were working with the States, there were about 15 States that were working that issue, and I think that maybe more than half of them have moved forward to deal with it.

A number of States have a pretty aggressive program now on air toxics, but today I just can't tell you the exact status of that.

[The information requested follows:]

Question

Do you know how many toxic air problems have been effectively regulated by the States since you've been here, since 1985 and since this discussion has been ongoing?

Response

As indicated by Table 1, considerable activity by State and local (S/L) agencies to adopt air toxics rules has taken place over the last 18 months. Seven S/L agencies have promulgated regulations and 14 S/L agencies have draft regulations undergoing review. Two States have passed new legislation that addresses air toxics and will result in future regulations. Twelve other S/L agencies have in the same timeframe expanded their existing new source review process to address air toxics concerns. This progress is likely to continue and even accelerate since essentially every State and major local agency now has a multi-year development plan. These plans outline specific commitments to enhance their existing air toxics program or to adopt a program if they currently do not have one.

TABLE 1

State and Local Agency Regulations and Policy Implemented
June 1985 to December 1986

Regulations Promulgated	Regulations Proposed	Policies Implemented
Allegheny Co. SST (waste oil)	Maryland, N&E, ambient risk and technology based	Indiana, NSR
Puget Sound Air Pollution Control Agency, SST (waste oil) SP (special asbestos rules)	Idaho, SST (woodstove)	Ohio, ES-SP reg. devt.
Monterey Bay Unified APCD (CA) NSR	State of Washington Municipal Waste Combuster Operation and maintenance Rule	Kansas, SP ambient guidelines
Connecticut, comprehensive program	Idaho, PCB rule	Oregon NSR,I (New York Air Guide)
Kentucky, N&E	New Jersey, expansion of number of pollutants covered in program	Washington, NSR,I
Montana, SP (woodstove tax credit for clean units)	Arkansas, N&E program	Maine, NSR,I
New York LEGISLATION: Hazardous Substance Storage Facility Act.	New Mexico, NSR	Massachusetts, SP for NSR
New Jersey, Revised VOC rules, diesel engine rules final guideline on review of resource recovery units. LEGISLATION: Toxics Catastrophe Prevention Act, Non-Permitted Releases Penalty law, ECRA (requires certification of no toxics on property before sale)	Oklahoma, N&E program	New Hampshire, dioxin
	Wisconsin, N&E program	Rhode Island NSR for mun. waste incinerators
	North Carolina, N&E	Vermont
	South Carolina, N&E	Bay Area AQMD (CA), NSR
	New York, revisions to Air Guide One	South Coast AQMD (CA), NSR
		Sacramento, APCD (CA), NSR
		Colorado, NSR

Type Code:

NSR = new source review, N&E = new and existing sources, SP = specific pollutant(s) rule (i.e., acrylonitrile), SST = specific source type (i.e., waste oil combustors), I = informal policy (i.e., State of Oregon using New York Air Guide when reviewing new sources), ES = existing sources

Senator DURENBERGER. Okay. One last question on that subject, so that we get on the record your instincts about the abilities of the States to regulate hazardous air pollutants. I'd like to use an analogy that would compare air pollutant regulation with the Superfund program.

In Superfund, we have the National Priorities List of 900 Superfund sites, which are all across the country, but the risks that are posed by these sites are generally quite localized. They have high risk but relatively few people.

Now, imagine that you have that NPL sitting right there in front of you, and you lay right down next to that a list of the chemical plants and the refineries and the smelters and all these other sources of toxic air emissions across the country. And again you have basically high risk to a few people, but you're looking now at two lists. And what I'd like to have you explore with us is why you think that Superfund list in front of you makes a case for $8.5 billion in a Federal cleanup program, and the list of sources of toxic air pollutants justifies no more than this kind of voluntary relationship with the States.

Mr. THOMAS. A fair question and clearly one that you've debated in Congress and made choices on. You decided to put the $8.5 billion on Superfund.

We have debated within the Agency as we have submitted budget requests. I requested additional resources on air toxics, clearly not at a magnitude of Superfund.

They are very different issues. They are the same in the sense of health protection. They are different in the sense of environmental protection, and I think you would factor in an environmental equation with Superfund on ground water that you probably wouldn't factor into the point sources on air toxics. You would factor in a more immediate health problem as far as air toxics are concerned. Many of the Superfund sites you wouldn't factor in, although some of them you would because you're dealing with the same kind of immediate health concern at some of the Superfund sites, so it's different in that regard.

It is the same, for instance, in that many times with air toxics when you're talking about the pollutant-by-pollutant localized problems, you are talking about a pollutant from a point source. It is not a national issue. It's a local issue. There are some that are national; we are working on those. There are some that are large area sources; we're working on those. But in many cases, you do have individual sources that are very localized in nature.

It's hard to draw a comparison between the two. There are some things that are the same, some things that are different. And ultimately, I've looked across our agency at what we do, how we compare the risk that we try to protect, and how we relate that as far as resources are concerned, and I find that one of the things we should look at is risk. But clearly, when we look at public policy, we look at more than that. When Congress debated and decided that they wanted to put the priority attention on Superfund that they did, I supported that. That doesn't mean I say that is in lieu of the priority that we put on air. It is just an issue that, for a variety of reasons, we wanted to put the kind of money on that we did.

Also, I think finally, on the Superfund side, we've got a very different equation as far as how to pay for the controls. On the air toxic side, we are very closely aligned to the clear "polluter pay" approach that we've taken in the majority of our environmental laws. On Superfund, clearly we have a "polluter pay" approach, but in many cases, for timeliness sake and also in some cases where it's very difficult to identify the polluter, I think you need a substantial additional amount of Government money to move that than you would on something like air toxics. So it's apples and oranges to a certain extent when you talk about money requirements.

Senator DURENBERGER. Well, I thank you for the comprehensiveness of that reply, and I suspect that we'll be back in the next few weeks and months discussing those various elements.

Finally, Mr. Chairman, let me ask you, Lee, about the new category in your listing program which some people suggest might be illegal, and that's the intent to list a category. Before you made that determination to go with the intent to list, did you have an opinion from legal counsel as to its appropriateness?

Mr. THOMAS. That was an issue, actually, that was discussed with Bill Ruckleshaus, and he moved forward with that. I reviewed it and continued to move forward with it, and I would suggest, if you want to change the law, that you would incorporate it in the law, and I'll tell you why. I think it has a lot of advantages.

When you go forward with a proposal to list, you actually have gone beyond "do we think it is a risk" to the point that you have concluded that clearly you think it is, and you have concluded how it should be controlled. In other words, in these regulations they are basically control technology regulations where you're putting on the street the kind of technology, and then you have a very stringent time frame after you do that to actually finalize and get moving.

An intent to list gives you a lot of flexibility to try to get on the street quickly information as to whether you think there's a health risk that needs to be dealt with, and let people know that you intend to move forward to deal with it. It's very public. You set up a time frame within which you intend to do it. And frankly, I think you get earlier controls. I think you get industries who see your intent to list; they immediately begin to review. Do I have that situation at my facility? Should I control that facility?

In short, before we ever move forward and start refining our control technology that's going to be proposed for the street, it also gives us the ability to cast the net very widely. We say, "We intend to list this pollutant. Everybody who is a point source of this pollutant, we want to know about it and we want input as to volumes and as to control technology that is in place, that can be put in place." We get as much information as possible. So it is an early flag, and we can move it far quicker than we can a full proposal, and I think it has a lot of public health advantages.

Senator DURENBERGER. As the net is thrown, however, what is the impact of its being thrown—this intent list being thrown—is having or would have on State intent to regulate? It seems to me it would have a rather chilling effect on States going ahead with regulation once they saw it on your intent list.

Mr. THOMAS. Actually, I don't believe so. We try to have a good, ongoing communication with States in air programs, like in other programs, and we work closely with them in this. The States don't have any more ability than we do to get a regulation developed that's a control technology regulation. As a matter of fact, if they are way ahead of us on an intent to list regulation as far as their technology review on a pollutant, using their information would just speed us up. If they saw we intended to list something, I don't think it would do anything other than encourage them to communicate with us to ensure that what they were going forward with is consistent with our technical information. I don't believe it's impeding their program. If anything, it may be speeding up their program where they say, "EPA intends to list this pollutant. Let's review closely what all of our point sources are for that pollutant and determine whether we want to put controls on now versus later."

Senator DURENBERGER. On the issues of legality of the intent to list, did I hear you say you don't know whether it's legal or not?

Mr. THOMAS. Well, we think it's legal, clearly, and we've got General Counsel defending us in court on that.

We have litigation on the whole 112 process, sir.

Senator DURENBERGER. All right.

Thank you, Mr. Chairman. Thank you, Mr. Thomas.

Senator BURDICK. Thank you, Mr. Thomas, and your associates for your contribution this morning. We're dealing with a very difficult subject, and we appreciate it.

I believe there will be questions in writing for the record from the various members of the committee, and I hope you can handle that in a timely manner.

Until we meet again.

Mr. THOMAS. Thank you, Senator.

[Whereupon, at 11:50 a.m., the hearing was adjourned.]

[Mr. Thomas' written statement follows:]

STATEMENT OF
LEE M. THOMAS
ADMINISTRATOR
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION
OF THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

APRIL 22, 1987

Thank you for giving me this opportunity to talk about the Clean Air Act. I know some members of Congress are considering various ways of amending the Act, and I want to comment on those efforts.

In one sense, the Clean Air Act is the flagship among all the environmental laws that I administer at the Environmental Protection Agency (EPA). It was the first major piece of Federal pollution-control legislation enacted in this country. Congress passed it in 1970, the same year that EPA was founded. Both events reflected a national commitment to protect the environment and human health from the potentially adverse side effects of an industrialized, technologically-advanced society.

Since then, the Clean Air Act has served this country well. It has led to substantially reduced emissions of a number of air pollutants. It has led to the development and use of a variety of technologies to control mobile and stationary source air emissions. In general, air quality nationwide is demonstrably better now than in 1970, largely due to the Clean

Air Act. Because of our national success in protecting air quality, the Clean Air Act is the model that other industrialized nations study when they are faced with their own air quality problems.

This is not to say that the Clean Air Act is unflawed. Any law based on the scientific understanding of chemistry, human health, and environmental processes will tend to become dated as scientific understanding improves over time. Any law enacted to protect the environment from specific kinds of problems will tend to be less useful as the problems evolve over time in unforeseen ways, and as new problems develop.

Congress meant the Clean Air Act to be an evolving piece of legislation. It was amended substantially in 1977, at which time Congress also established a National Commission on Air Quality to study the law in depth and then to make recommendations on how it could be improved further in the future.

The Report of the National Commission on Air Quality was published in 1981, and several bills to amend the Clean Air Act have since been submitted in both the Senate and the House of Representatives. That report and those bills were intended to rectify perceived deficiencies in the effectiveness of the law. However, EPA is still implementing the law as it was amended a decade ago.

The current impetus to amend the Clean Air Act seems to be driven by two major concerns: acid rain and ozone nonattainment. These two air quality problems provide an enlightening context for a discussion of the merits of the Clean Air Act, because, from a legal and regulatory perspective, they provide a study in contrasts. First, acid rain is not mentioned in the Clean Air Act. In fact, it was barely recognized as an environmental problem when the Act was written. Ozone, on the other hand, was specifically mandated for control, and a specific date for compliance was included in the Act. Second, there is no clear understanding of the extent to which total loadings have to be controlled in order to protect the environment from acid rain. The target for control of ozone is explicit and well-documented by scientific data. Third, the costs of an acid rain control program generally would not be borne by the same people who enjoy the environmental benefits, whereas the costs and benefits of ozone control will generally be focussed in the same areas.

Despite these differences, acid rain and ozone seem to be providing the major impetus for discussions on amending the Clean Air Act. Because of these differences, which I am going to discuss today in greater detail, I believe Congress should treat them quite differently, especially in the context of any near-term amendments to the Act.

ACID RAIN

First of all, I would like to add to my past testimony on acid rain. Each time I or my predecessor has appeared before Congress over the past three years to testify on acid rain, we have stated unequivocally: "There is no doubt that there is an acid rain problem in this country." And we have pledged: "When the fundamental scientific uncertainties have been reduced, this Administration will craft and support an appropriate set of measures to solve the acid rain problem." We have maintained that a decision on additional controls without such knowledge would be inappropriate, not because controls are unnecessary or too expensive, but because it is premature and unwise to prescribe emissions controls based upon an inadequate scientific understanding of the problem.

To fulfill this pledge to address the acid rain problem, this Administration has made a major effort to obtain the scientific, analytical, and administrative answers needed to craft a solution. Three years ago, we initiated a three part acid rain program involving accelerated research, ongoing policy analysis, and Federal/State studies of implementation issues. Last year, consistent with the President's endorsement of the Special Envoys Report, the Administration added the commercial demonstration of emerging retrofit control technologies as a fourth element of the program. Further, EPA actively continues to actively implement the existing provisions of the Clean Air Act that control acid rain precursors. Each of these activities represents an important part of EPA's coherent and comprehensive acid rain program.

I believe that our policy and programs have been sound, even though they have not always been well-received by either the proponents or the opponents of a control program. Partisans on both sides of the issue seem uncomfortable with the prospect of an evolving science that may not fully sustain their current views. I believe that the progress we have made and the prospects to come are both relevant and timely to your discussion of possible legislation. Therefore, I would like to review each of these five areas, highlighting both our current results and the prospects for additional progress.

Research

The most visible single element of our acid rain program is the research. From a FY 1983 level of 22.7 million dollars, the budget of the National Acid Precipitation Program (NAPAP) has increased steadily to a level of 85 million dollars in FYs 1986 and 1987, and it is expected to remain at that level through FY 1989. The expanded funding has been consciously directed into those areas of greatest significance to policy resolution. Our intent is not simply to increase our scientific understanding of acid rain, but to gather the scientific information necessary to make a prudent decision on the need for additional controls. Early in the program we identified the principal scientific uncertainties hindering policy development. Revisiting and updating these needs has been achieved through ongoing policy analysis. Carrying out research targetted to reduce those uncertainties, has been our major goal over the past three years.

Just a few years ago, we had little information on the extent and magnitude of acid rain's effects on aquatic systems. We had little capability to predict the extent and rate of future damage, or to estimate the recovery rate of aquatic systems if deposition were reduced. Sufficient data on the extent, magnitude, and causes of damage in forests were not available.

We also recognized that qualitative answers alone would not be sufficient to base judgments on quantitative emissions reduction that could require the expenditure of tens of billions of dollars. I am pleased to report to this Committee that we are making substantial progress in determining what resources are at risk, and where, and over what time frame. I believe that we can have even more detailed answers to those questions within a reasonable period of time.

Let me be more specific. In the area of surface water acidification, we have initiated two major research efforts: the National Surface Water Survey to help determine the current extent and distribution of acidic surface waters; and the Direct/Delayed Response Project to help us to estimate the rate and magnitude of future acidification.

Phase I of the Eastern and Western Lake Surveys were published in August of last year and January of this year, respectively. Under current schedules, we anticipate that by mid 1988 we will see the results of Phase 2 of the Eastern Lake Survey, Phase 1 of the Eastern Stream Survey, and the

direct/delayed response estimates for the Northeast and Blue Ridge Province. Preliminary results from our analysis of episodic effects also should be available. These results will provide statistically defensible estimates of the current extent of surface water acidification and, in combination with projected emissions trends, expected rates of future acidification on a region-by-region basis for the Eastern United States.

In the area of forest research, we have established four major research cooperatives, each addressing a different major forest type, to test the major hypotheses of forest decline. The preliminary results of research on eastern spruce/fir and southern pine forests, which are expected to become available during the next two years, should provide us with strong qualitative indications of whether or not sulfur deposition is a significant factor in forest decline. A determination of the contribution of other air pollutants, such as NO_x, O_3, and heavy metals, to forest decline should be available soon thereafter. Currently, we have no scientifically defensible basis to judge that either sulfur or nitrogen deposition adversely affects forest productivity.

In the area of atmospheric sciences and source receptor modelling, we now have enough years of data on wet deposition across the United States to determine annual average deposition rates and short-term trends. We anticipate that we will have developed a state-of-the-art source-receptor model by late 1987 or early 1988. That model then will be field-tested thoroughly.

NAPAP has as one of its primary goals the production, by the end of its ten-year existence, of an integrated assessment of the acid rain problem in the United States. However, we have never intended to wait until the assessment is complete, if adequate answers can be found before then. Consequently, we have insisted that our research projects be designed to lead to near-term and mid-term incremental improvements in scientific understanding, not just long-term results.

As an example, last December I charged my research staff with the task of pulling together the most recent data and then taking those data as far as they could analytically to see if they could give us some of the answers we are seeking. I encouraged them to push themselves intellectually and to be willing to take some analytical and scientific risks. I made this request in the hope that we could find answers that would enable us to move forward on an acid rain decision in the near term.

A special workshop this last month brought together a panel of outside experts and scientists who generated the analyses. Since that workshop, I have met with many of the outside reviewers, who were very supportive of the effort. But they concluded that because of data limitations the attempt to predict future damage was premature. However, they did strongly support the approach, and they felt that the effort underway to acquire the needed data should be adequate. I am relating this to you because I think it is illustrative of our efforts to resolve these scientific uncertainties as soon as possible.

Policy Analysis

The second element of our acid rain program is ongoing policy analyses of both the implications of the research and the consequences of possible control programs.

As you are well aware, a number of different approaches to controlling precursor emissions have been proposed. In the past, Committee members and staff alike have relied heavily on EPA-sponsored analyses of major House and Senate acid rain bills.

We have conducted preliminary analyses of several bills currently being considered by this Committee. This includes quantitative "upper bound" estimates of the emissions and cost impacts of some provisions of S. 300 and S. 321. We have also conducted preliminary analyses of one interpretation of the utility control provisions of S. 316. We view all of these results as incomplete and subject to change pending more detailed examination. However, they do provide good first estimates of the effects of the different approaches to acid rain control which they embody.

S.316 achieves its reduction in two phases, requiring States to meet both a 1.2 lb SO_2/MMBTU average emissions rate and an emissions ceiling by 1998. States and sources then can choose a combination of controls that will meet those targets. They are allowed the option of interstate trading. EPA's estimates of the cost-effective response to

the SO_2 portion of this bill shows a 9-10 million ton reduction with cost ranging from $2.3 to $3.2 billion per year. If States default, costs could go as high as $5.3 billion per year.

S.321 requires both a 12 million ton reduction by January 1, 1996, and a State annual average emissions rate of 0.9 lb SO_2/MMBTU. After 1996, each plant, as it reaches 30 years of age, must meet 0.9 lb SO_2/MMBTU, or the State must meet a declining emissions cap. Our upper bound estimate of this more stringent legislative approach indicates about a 40 percent greater emissions reduction at a cost more than double that of S.316.

S.300 requires all utility boilers to meet a 0.9 lb SO_2/MMBTU monthly average emissions rate by 1991, with higher rates for some units with limited operation. At 30 years of age, boilers must meet NSPS. This approach achieves the highest reductions of the three bills we have reviewed, at over 14 million tons. However, our upper bound estimate shows costs more than three times greater than S.316.

Implementation Issues

The study of implementation issues is the third major element of our current acid rain program. Implementation issues are the procedural, technical, and administrative barriers that can hinder or prevent the successful implementation of any control program. In the past, implementation issues often have been the most critical link between

legislative intent and environmental results. Unfortunately, they also tend to receive the least forethought. In pursuing implementation issues, we are not presupposing the need for additional controls. But if they are needed, we want to be sure that everyone, including the States, is ready and able to make them work.

Therefore, we have been actively involving State governments in this effort with three million dollars from EPA's 1985 budget for grants to State air programs. Grants have gone to 36 States, and results from the studies are now coming in. We also have two national workshops with the States to improve our understanding of the issues and to help shape possible solutions to potential implementation problems.

For example, we know in the States with complex regulatory and review procedures that a minimum of 30 months from enactment would be needed for a State to resolve conflicts between competing interests, prepare and adopt its plan, and submit it to EPA for review and approval. Also, the credibility of a bill's default provision would make a significant difference in the timeliness and adequacy of the State's proposed plan.

Furthermore, States and EPA agree that the economic and social consequences of a State's control plan would require the involvement of multiple interests and actors at the State level. Thus, preparation of an acid rain control plan,

if required, would not be a task simply for the State air pollution control agency. The interstate nature of utility operations, and the interstate ownership and operation of utilities, also must be considered in acid rain proposals and State plans, if they are to be implemented effectively.

As a result of the implementation issues program, many States are developing a much better understanding of the procedural data and analytic methods they would use, if necessary, to design and implement an acid rain control program. In addition, many States have developed vastly improved data about the sources of emissions and costs of control measures within their States. These preparations, when completed, will improve the likelihood of successful and rapid implementation in the event the Administration determines that acid rain control action is needed.

We expect to synthesize the results of the EPA/State studies by the end of this year. We will then integrate the knowledge gained from this effort into program options during FY 1988, as appropriate.

Retrofit Technology Demonstration

Prior to 1980, the Agency's work in the area of SO_2 and NO_x control technology has been used to support the development of New Source Performance Standards (NSPS). This work has helped to facilitate both development and demonstration of:

1. Several flue gas desulfurization (FGD) or scrubber systems for high efficiency control of SO_2 from coal-fired utility boilers;
2. The addition of specific organic acids to FGD systems to improve the operability and SO_2 control efficiency of the systems at reduced cost; and
3. Low-NO_x firing systems that offer an effective low-cost approach to reducing nitrogen oxides emissions.

These systems are the current state-of-the-art emissions control technologies for new utility boilers, but many can also can be retrofitted on existing boilers. In EPA's view, the most important focus of clean coal technology development efforts would be coal-fired retrofits. More than 65 percent of U.S. SO_2 emissions currently come from coal-fired plants. This figure gains additional significance because of recent practice of rehabilitating and repowering those plants, thus increasing their useful lives. Life extension of those plants by two or more decades beyond what was previously anticipated may alter one of the Clean Air Act's fundamental assumptions concerning control strategies. While it is still true that new sources subject to more stringent standards will gradually replace existing sources, this will occur at a much slower pace than was expected when the Act was last revised. Furthermore, because such a high percentage of SO_2 and NO_x are emitted from existing coal-fired boilers, we believe it is appropriate to focus Federal resources on technologies that could affect these

emissions. Therefore, since the early 1980s, EPA has been working more recently on technologies with the potential for low-cost, moderate-to-high SO_2 control for existing boilers. For example:

1. EPA has developed the LIMB (Limestone Injection Multistage Burners) process that uses low-NO_x burners for NO_x control and furnace sorbent injection for SO_2 control. LIMB, which is particularly attractive as a retrofit technology because of its low capital costs, could remove up to 50-60 percent of SO_2 and NO_x at a lower capital cost than FGD, and it requires little room for retrofit.
   - o The wall-fired boiler demonstration is scheduled to begin operation in mid-1987 at the Edgewater plant of Ohio Edison.
   - o A tangentially-fired boiler demonstration procurement has been initiated; however, final contract negotiations have not been concluded.
2. EPA has developed several other technologies for lower-cost SO_2 control, including the E-SO_x process (a low-cost, SO_2 removal technology that can be retrofitted into boilers that presently use electrostatic precipitators). The E-SO_x process uses advanced Electrostatic Precipitator (ESP) technology to free duct space needed for sorbent injection. Small pilot-scale testing shows the potential for 50-70 percent SO_2 capture in selected existing ESPs with capital costs

significantly less than conventional FGD. A large pilot-scale demonstration has been selected for negotiation under the State of Ohio coal technology program with Babcock and Wilcox and EPA as co-sponsors.

3. EPA has performed basic bench- and pilot-scale development on reburning technology for NO_x control. This technology involves the addition of secondary fuel and air above the primary combustion zone. It can reduce NO_x emissions by 50 percent or more. EPA is in final negotiations for a project to demonstrate reburning technology for NO_x control on a cyclone-fired boiler. The goal is to achieve 50-70 percent NO_x control on a class of boilers that are not readily adaptable to low-NO_x burner technologies.

The Joint Envoys' report included a recommendation stating that "more consideration should be given to projects that demonstrate retrofit technologies applicable to the largest number of existing sources..., [and] special consideration should be given to technologies that can be applied to facilities currently dependent on the use of high-sulfur coal." This is entirely consistent with the EPA efforts currently underway.

The Department of Energy is also conducting research in Clean Coal Technology (CCT). On March 18, 1987, the President announced that he would seek the full amount of the government's share of funding recommended by the Joint Envoys, $2.5 billion, for

demonstration of innovative control technologies over a five year period. Consistent with this announcement, the Administration has amended the FY 1988 budget request and supporting outyear estimates for the CCT-innovative control technology program.

Implementation of the Current Clean Air Act

Regarding the last element of EPA's acid rain program -- active implementation of the existing Clean Air Act -- let me make two points. First, despite the fact that the ambient program is not directed at reducing total loadings, over the past 10 years (1976-1985) the effect of that program, plus the stringent control of new sources, has resulted in a 21 percent reduction in total annual SO_2 emissions. It also has caused the rapid growth in NO_x emissions to level off.

The second point regards the future trends of those pollutants. Without any major new regulatory programs, and assuming moderate economic growth, we expect SO_2 emissions during this century to vary between current levels and a 10 percent increase. We expect NO_x emissions to rise no more than 15 percent over the same time period.

To conclude my remarks about acid rain, I will simply restate one of the main points of my past testimony on the subject. I see no compelling need for any near-term amendments to the Clean Air Act to require acid rain controls, given our current lack of understanding of either the

quantitative nature of the problem or the quantitative benefits of any particular acid rain proposal, and given the research results we expect to see in the next one or two years.

OZONE NONATTAINMENT

Ozone nonattainment, on the other hand, presents us with a different kind of problem. Ambient ozone concentrations in excess of the national ambient standard undoubtedly pose a threat to human health and the environment. In spite of the fact that we have made substantial progress reducing emissions of volatile organic compounds (VOCs) and, consequently, ozone concentrations nationwide, approximately 70 different metropolitan areas across the country are not meeting the ozone standard. Many of those will not attain the standard by the December 31, 1987 target date. This situation can be attributed to a number of different factors, some of which I will describe in more detail later in this testimony. But the fact remains: many areas are not going to meet the ozone attainment deadline by the end of this year, and the Clean Air Act gives us little guidance on what actions we should take under such circumstances.

There can be little doubt that ozone nonattainment is an environmental and human health problem of legitimate national concern. Studies indicate that elevated ozone concentrations occurring on some days during the hot summers in many of our urban areas may reduce lung function, not only for people with preexisting respiratory problems, but even for people in good health. This reduction in lung function may be accompanied

by symptomatic effects such as chest pain and shortness of breath. Observed effects from exposure of 1 to 2 hours with heavy exercise include measurable reductions in normal lung function in a portion (15-30 percent) of the healthy population that is particularly sensitive to ozone. While many of the measured effects observed in humans appear to be transitory and reversible, there is concern that repeated exposures may cause long-term damage to the lungs. However, at present our ability to determine the consequences of chronic long-term human exposures is limited.

Even more worrisome is the possibility that recurrent ozone exposures over a period of years may result in permanent damage to the lungs. Such damage has been observed in animals exposed continuously for several months to ozone concentrations comparable to the peak short-term concentrations found in some urban areas. Data from animal toxicology studies, clinical studies of humans, and real-world epidemiological studies all suggest that ozone concentrations currently being encountered in many urban areas may be harmful to human health.

Another consequence of the ozone nonattainment problem is its effect on welfare. Studies have shown that elevated levels of ozone can decrease the yield of several important agricultural crops, may have caused severe damage to trees in California, and may be contributing to forest decline in the eastern United States. Because most controls are

implemented to meet the national health standard, the currently estimated welfare effects associated with ozone are relatively small compared to the likely cost of control. However, it is clear that ozone nonattainment is an environmental problem of legitimate national concern.

The Clean Air Act calls on States to develop State Implementation Plans (SIPs) that demonstrate how they will attain and maintain the national ambient standard for ozone (i.e., 0.12 parts per million). The SIPs describe the specific control measures needed to achieve attainment in each State. In order for a SIP to be approved by EPA, it must include enforceable regulations that provide for attainment of the standard. The States are then responsible for implementing and enforcing the SIPs.

In theory, if a State implements every control measure in an approved SIP, it should attain the standard by the target date. However, in many areas this has not happened, and there are several reasons why.

First, the formation of ozone is dependent on complex meteorological events and the interaction of volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in sunlight. Because our scientific knowledge of atmospheric chemical processes and weather patterns is inexact, the ozone reductions expected to be achieved by the specific control measures identified in the SIPs sometimes were overestimated by States and EPA.

Second, the economy has grown more, and in different ways, than was estimated in some of the SIPs. For example, vehicle miles travelled (VMT) have grown far more quickly than expected when most SIPs were developed. In the Los Angeles area, VMTs have increased by about 55 percent over the past 16 years, while the population has grown by only 25 percent over the same period. Thus our success in attaining the standard has been undercut in many areas by unforeseen economic growth.

Third, when most SIPs were approved, our understanding of the kinds and numbers of emissions sources that contributed to ozone was less than perfect. For example, only recently have we begun to recognize that publicly-owned water treatment works and hazardous waste treatment, storage, and disposal facilities are significant sources of ozone-causing VOCs. In other cases, the information available when the SIPs were developed led to an underestimation of the VOC reductions needed to reach attainment in many cities. The contribution of mobile sources to the ozone problem was also underestimated in many areas.

Fourth, some areas failed to reach attainment simply because they did not implement all of the elements of their SIPs, or else failed to implement them effectively. Thus they did not achieve the level of emissions reductions called for in their SIPs.

The question we all face today is simple: given the serious nature of the ozone problem, and given the fact that ozone nonattainment will be widespread at the end of the year, what steps should we take within what timeframe to ensure nationwide attainment of the ozone standard?

The answer to that question, on the other hand, is anything but simple, and much of the complexity is related to the question of timing. On the one hand, we want to reduce the health risk from ozone as quickly as possible. On the other hand, the social disruption involved in attaining the standard will be inversely proportional to the amount of time allowed. That is, the less time allowed to reach attainment, the more disruption. Many of the worst nonattainment areas in this country simply cannot reach attainment within the short term--that is, within a few years--unless they implement some extremely harsh--some might say heroic--and costly lifestyle-changing measures. Other areas could meet attainment with relatively less difficult actions taken over a relatively short time. The different circumstances of the different nonattainment areas is one of the factors that most complicates the life of air program managers at EPA and in State and local control agencies.

There are a number of actions that EPA can take under the current Clean Air Act to keep the country moving toward ozone attainment. We've begun taking them. For example, we will continue to implement the Federal Motor Vehicle Control Program (FMVCP) with its associated automobile

inspection and maintenance (I&M) program. Despite expected growth in VMT, that program alone should result in about a 20 percent decline in national VOC emissions by 1995, which could bring about 30 areas into attainment.

In order to achieve the potential reductions from motor vehicle controls, EPA is working to ensure that State I&M programs are operating responsibly and effectively. When EPA identifies problems in a State I&M program, we encourage the States to correct them. About six weeks ago I sent letters to the governors of four States with insufficient I&M programs calling on them to submit corrective I&M plans and then implement and enforce them. I&M programs undoubtedly help reduce mobile source VOC emissions, and we at EPA are working to ensure that such programs are implemented effectively wherever they have been established.

In order to reduce ozone concentrations nationwide, EPA is considering some new VOC controls that would be applicable everywhere in the country. For example, a regulatory program to reduce gasoline volatility could reduce nationwide VOC emissions by as much as 8 percent by 1995, while controls on refueling emissions would result in perhaps as much as another 2 percent reduction by the year 2000.

The full implementation of existing SIP requirements also would help reduce VOC emissions nationwide. In order to ensure that existing SIPs are achieving their intended

results, EPA has initiated a program to review the effectiveness of SIPs in all nonattainment areas. Two weeks ago I wrote the governors of all States with nonattainment areas informing them of this program. Our Regional Offices have been in touch with the top environmental officials in each State to communicate the same message.

We are serious about enforcing current SIPs, and upgrading those SIPs that are not adequate for meeting the standard. We want to make certain that the States adopt the measures described in their SIPs, that those measures are adequate for attainment, and that the SIPs are implemented effectively.

In order to ensure full and effective implementation of SIPs, EPA is prepared to apply the economic sanctions defined in the Clean Air Act. In some areas, we have discretion in applying sanctions. For example, in cases where a State is failing to implement its SIP, EPA may impose a ban on certain major new construction in the nonattainment area. In addition, air program grants and sewage treatment grants may be withheld.

In other cases, the Clean Air Act narrowly limits EPA's discretion. For those areas of the country whose plans fail to demonstrate attainment by the end of 1987, the Clean Air Act requires EPA to disapprove their plans and, in some cases, to impose economic sanctions. For some of these areas, EPA

would be required to impose a ban on certain major new construction, and the Agency could, at its discretion, withhold sewer construction, highway construction, and air program grants. For other areas EPA could impose all of these sanctions at its discretion.

We have not yet determined which States fall into which of the various categories. It is still too early to say which sanctions EPA will have to impose, which sanctions we will choose to impose, and which States will have to face sanctions of either kind. But it is certainly time that we all recognize the seriousness of the ozone nonattainment problem we are facing today.

I am not looking forward to the imposition of sanctions. They will cause economic disruption wherever they are applied, and the political repercussions will be felt by all of us. However, the use of sanctions in some circumstances may be necessary to convince some States that we are serious about the planning process that they must undergo in under to demonstrate attainment. In other circumstances, the use of sanctions is mandatory under the law. I expect that EPA will be able to define exactly what kinds of sanctions will be proposed in what areas sometime this summer.

I am fully aware that the imposition of sanctions is a politically sensitive action that, in some circumstances, could lead to protracted litigation. The Clean Air Act is

simply unclear in respect to when Congress wanted sanctions applied, and which ones. Over the next few months, I will be taking actions within our best understanding of the law.

However, the current law gives us little guidance on how to treat areas that do not demonstrate attainment by the end of this year. In other words, the Clean Air Act does not now address the problem of long-term, chronic nonattainment. Despite the VOC emissions reductions that will result from the kind of near-term actions I described earlier, many ozone nonattainment areas still will not meet the national standard in the foreseeable future. Some of those areas need to reduce VOC emissions by 50 percent or more, and reductions of that magnitude will require political consensus and serious longrange planning. It could be quite useful to review and revise the issues of sanctions and deadlines.

How much time should such areas be given to reach attainment? Should there be any deadline at all for reaching attainment? Should the deadline be the same in all areas? Based on my experience implementing the current law, I believe that deadlines are essential in order to force action. But they must be realistic. They also must take into consideration the practical problems involved in reaching attainment in the worst areas. I suggest that we will achieve the most fruitful results in all kinds of nonattainment areas if we tailor the attainment deadline to the specific circumstances of each nonattainment area.

Let me sum up my position on the need for Clean Air Act amendments for acid rain and ozone nonattainment. For acid rain, I do not believe that a decision on the need for a large, near-term reduction in emissions as called for in bills currently before the Senate is appropriate or compelling at this time. I have articulated my reasons for that position on many occasions, and again today. As far as ozone is concerned, I believe our current method of setting the standard is workable and effective.

Finally, I would like to comment on the Clean Air Act as a whole. Clearly, acid rain and ozone nonattainment are not the only issues that could be clarified by amendments to the Clean Air Act. The National Commission on Air Quality made literally dozens of recommendations for changes covering virtually every part of the law. However, I think everyone recognizes that the Clean Air Act, as technically complex and flawed as it may be, is a very workable law that could continue to serve us well for many years to come.

With the possible exception of the provisions for nonattainment, we are also able to live with the law as is. The law has worked in the past, it is working today, and I am confident that even in its current shape it can continue to work for years into the future.

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Director
Gene E. Likens

2 June 1987

The Honorable
Robert Stafford
United States Senate
Attn: Curtis Moore
Senate Committee on Environment and
Public Works
Senate Office Building
Washington, D. C. 20510

Dear Senator Stafford:

I have seen the April 22nd testimony of Mr. Lee Thomas, Administrator of the Environmental Protection Agency, and believe that this testimony does not accurately reflect the scientific understanding about acid deposition and its effects. There is appreciable consensus within the scientific community about the acid deposition issue, and the need for a reduction in emissions of SO_2 to protect sensitive ecosystems. The enclosed report provides some of the details, and may be of use in your deliberations.

Sincerely,

Gene E. Likens
Director

Enclosure

GEL/jbc

cc: Lee M. Thomas

16 October 1985

To Those Concerned with Resolving the Acid Rain Issue:

Over the past four to five years, the Congress has considered various amendments to the Clean Air Act designed to address acid rain. These bills have typically called for reductions in sulfur, one of the major precursors to acid rain. Congress is once again considering sulfur-control legislation.

During these few years, we as research scientists have perceived that the barrage of conflicting views and information presented by the media, in published reports, and in congressional testimony has created an impression of scientific confusion and uncertainty on major aspects of acid rain in the minds of policymakers, regulators, and the public. We believe that neither the Congress, the Executive Branch, nor the public is well served by an appearance of scientific uncertainty when the actual state of scientific knowledge is considerably more certain.

Based on our own research and review of the scientific literature, we are convinced that the scientific community now understands at least qualitatively--and in some cases quantitatively--the sequence of physical and chemical steps that lead from emission of oxides of sulfur and nitrogen in North America to eventual changes in widespread ecosystems, as well as the consequences of increasing or reducing the emissions of sulfur, nitrogen, and other air pollutants. The biological consequences of high rates of sulfur deposition on aquatic ecosystems are particularly well understood.

In light of these views, we formed an ad hoc committee to review six major scientific reports prepared by scientists and sponsored by the Executive Branch or the Congress. Our review sought to assess the degree of scientific consensus on major chemical, physical, and biological issues relevant to increased acid-rain controls. The result of our review is the attached document entitled "Is There Scientific Consensus on Acid Rain?". For 17 major scientific issues of acid rain, it excerpts relevant sections from the reports. Collectively, the excerpts show that strong scientific consensus exists on the major issues, even though uncertainty remains and further research is warranted. Even in areas where these documents indicate that large uncertainties remain, i.e., the precise contribution of sulfur

or nitrogen compounds to forest degradation, they show a general consensus, in this case that air pollution can stress forests. Lastly, we believe that these governmental reports establish a scientific consensus that reducing the emissions of a large number of air pollutants, most notably sulfur dioxide, would benefit biological systems in North America significantly.

Yours very truly,

Charles T. Driscoll, Ph.D.

James N. Galloway, Ph.D.

James F. Hornig, Ph.D.

Gene E. Likens, Ph.D.

Michael Oppenheimer, Ph.D.

Kenneth A. Rahn, Ph.D.

David W. Schindler, Ph.D.

Please contact the Institute of Ecosystem Studies, The New York Botanical Garden, Mary Flagler Cary Arboretum, Box AB, Millbrook, New York 12545, for additonal copies of the report.

IS THERE SCIENTIFIC CONSENSUS ON ACID RAIN?

Excerpts from six governmental reports

Ad Hoc Committee on Acid Rain:
Science and Policy

October 1985

INTRODUCTION

A group of scientists and others concerned with public policy met on September 24, 1984 at the Mary Flagler Cary Arboretum in Millbrook, New York, to consider the role of scientific information in formulating policy for regulating acidic deposition. The participants in the meeting, listed in the Appendix, perceived appreciable confusion and lack of awareness about the scientific information on acidic deposition which had been generated during the past 15 years. With a view to determining the extent of scientific consensus on major aspects of acid deposition, the scientists at the meeting created an *ad hoc* committee to compile statements on several key questions from six governmental reports (Table 1) of the past four years. Members of the committee were C. Driscoll, J. Galloway, J. Hornig, G. Likens, M. Oppenheimer, and K. Rahn. Additional material was provided by D. Schindler of the Freshwater Institute, Winnipeg, Manitoba and by R. Friedman of the Office of Technology Assessment, Washington, D.C.

This document is the result. It presents a series of direct quotations from the reports which in the aggregate show that scientific consensus exists on a number of significant points regarding acid deposition and its effects.

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Table 1. The six governmental reports cited in this document.

CARP	The Acidic Deposition Phenomenon and Its Effects: Critical Assessment Review Papers, Volumes I,II. USEPA Report EPA-600/8-83-016A, July 1984
NAS-1	Atmosphere-Biosphere Interactions: Toward a Better Understanding of the Ecological Consequences of Fossil Fuel Combustion, National Research Council, National Academy Press, 1981
NAS-2	ACID DEPOSITION: Atmospheric Processes in Eastern North America: A Review of Current Scientific Understanding, National Research Council, National Academy Press, 1983
NAS-3	Acid Deposition: Processes of Lake Acidification, National Research Council, National Academy Press, 1984
OSTP	Report of the Acid Rain Peer Review Panel, Office of Science and Technology Policy, July 1984
OTA	Acid Rain and Transported Air Pollutants: Implications for Public Policy, Report OTA-O-204, Office of Technology Assessment, U.S. Congress, Washington, D.C., 20510, June 1984

MAJOR AREAS OF CONSENSUS IN THE SIX REPORTS

1. What are the sources of acid deposition?

Man-made emissions of SO_2 and NO_x are the dominant contributors to acid deposition. Natural sources of these pollutants seem to account for less than 10% of total atmospheric loadings. Sulfur compounds are responsible for about two-thirds of the acidity in precipitation; nitrogen compounds, one-third.

These pollutants are frequently transported hundreds of miles, so that distant sources routinely add significantly to the contributions from more-local sources.

Acidity is deposited in both wet and dry forms. Wet deposition ("acid rain") is generally used to represent acid deposition because it can be measured more reliably than dry deposition can. Both wet and dry deposition acidify ecosystems, however.

2. How extensively has acid deposition damaged the environment?

Acid deposition can acidify streams, lakes, and soils. Acidification can change biological populations and communities as well as reduce the number of species in them.

Long-term acid deposition, particularly of sulfuric acid, has acidified surface waters in the northeastern United States and southeastern Canada to the extent that certain species of fish and insects have been reduced or occasionally eliminated. A host of other biological effects has also been noted. Acidification and associated biological effects have been found where sensitive surface waters receive acid deposition.

Acid deposition can acidify soils, especially those which are moderately acid initially. Acidification decreases the availability of nutrients and thus alters biological communities in soil. Acid deposited on leaves can leach nutrients which, if not replaced, will affect the trees. Some forests in eastern North America have been increasingly damaged during the past few decades; acidity alone or in conjunction with other pollutants such as ozone may contribute.

In addition to affecting biological communities in sensitive surface waters and soils, acid deposition and its precursors also decrease atmospheric visibility and corrode materials.

3. What will happen if we reduce the emission of SO_2?

Reducing the emission of SO_2 throughout a multistate region such as the eastern United States will reduce the deposition of sulfur over the same region commensurately.

Depending on its magnitude, a reduction in deposition will reduce or eliminate several types of damage to resources such as:

- acidification of aquatic ecosystems
- degradation of visibility
- soiling and damage to materials.

Reducing the emission of SO_2 will also reduce the exposure of crops, forests, and human populations to acidifying compounds of sulfur. The extent of benefits to these resources is more controversial, however, because the causes and extent of damage are less certain than for the former groups of resources.

4. What is the relationship between scientific information and policy?

Scientific information is necessary but not sufficient to determine policy. Environmental policymakers receive information on the extent of known and anticipated damages caused by certain practices, together with information on possible remedies. They then decide whether to alleviate some or all of the damages by comparing their societal importance to the societal consequences of changing the practices responsible for them.

Policymakers who are convinced that the identified damages to lakes, streams, materials, and visibility are unacceptable will advocate a policy to reduce them. Policymakers who believe that the identified damages are too small to justify action may require additional evidence or greater certainty regarding causes and remedies, however.

Substantial consensus exists on sources of acid deposition, on certain types of damage

caused by the deposition, and on likely effects of reducing the emissions responsible for the acidity. Adequate scientific information exists to select emission-reduction strategies to reduce acid deposition efficiently.

CITATIONS FROM THE SIX GOVERNMENTAL REPORTS

I. Questions on the atmosphere

A. *What fraction of sulfur and nitrogen emissions and deposition in eastern North America are man-made? What are the most important types of man-made sources?*

"In eastern North America, emissions of SO_2 and NO_x from human activities appear to be at least ten times larger than emissions from natural processes." (OSTP, p. III-1)

"Averaged over Eastern North America (east of the Mississippi and south of James Bay in Canada), natural background sources might contribute about 12 to 25 percent of the total. Another group has estimated natural sources of sulfur to be about 5 to 10 percent of manmade sources in this same region.

Natural background is estimated to contribute similar proportions of total wet nitrate deposition—about 10 to 25 percent when averaged over Eastern North America." (OTA, p. 279)

"Present evidence does not show that natural sources of sulfur compounds are significant contributors to excessively low precipitation pH when compared to anthropogenic sources." (CARP I, p. 2-102)

"On a quantitative basis and for the area of the United States east of the Mississippi River, soil-generated natural sources of sulfur compounds are estimated to total about 0.07 Tg S yr^{-1}. Thus, less than 1 percent of the sulfur compound emissions in this regional area seem to be due to natural sources, even though this natural source estimate might vary by a factor of 2 or 3." (CARP I, 2-102)

"Only a few percent of the NO_x contribution to acid precipitation may be due to natural NO_x sources." (CARP I, p. 2-102)

"For example, in eastern North America (i.e., east of the Mississippi River), 90 to 95 percent of precipitation acidity may be the result of human activities, although natural sources may also be important at times in specific locations." (NAS-2, p. 13)

"There are no known natural causes that can account for either the distribution or the value of acidity in eastern North America. The region of highest acidity does, however, correspond to the regions of heavy industrialization and urbanization along the Ohio River Valley and the Eastern Seaboard, where anthropogenic emissions of sulfur dioxide, nitrogen oxides, and hydrocarbons are high." (NAS-2, p. 13)

"For the Nation overall, the major sources of sulfur dioxide emissions—about 90 to 95 percent of the total—are electric-generating utilities, industrial boilers, and industrial processes. Similarly, three sectors—utilities, mobile sources, and industry—produce more than 95 percent of the country's manmade nitrogen oxides emissions." (OTA, p. 57)

"The largest increases in SO_2 emissions over this period (1950-1980) occurred in the Southeast, where nearly 90 percent of the total sulfur oxides emitted are attributed to electric utilities and industrial fuel combustion sources." (CARP I, p. 2-106)

"Copper and nickel smelters represent the major Canadian SO_2 source category, with most point sources located in eastern Canada." (CARP I, p. 2-107)

"Electric utilities and highway vehicles are the largest contributors to NO_x. Highest NO_x emissions densities occur in the northeastern United States and are influenced by highway vehicles. Coal-fired utilities significantly affect the NO_x emissions in the Midwest." (CARP I, p. 2-107)

What fraction of the acidity of precipitation originates in sulfur and nitrogen compounds?

"In the East, sulfur compounds currently contribute about twice as much acidity to precipitation as nitrogen compounds." (OTA, p. 16)

B. *What is the characteristic lifetime and scale of transport for sulfur in the atmosphere?*

"Pollutants emitted into the atmosphere can return to earth almost immediately or remain aloft for longer than a week, depending on weather patterns and the pollutants' chemical interactions." (OTA, p. 5)

"Substances that are highly reactive—e.g., NO, HCl, SO_2, HNO_3—and/or have a high solubility in water—e.g., NH_3, SO_2—or hygroscopicity—e.g., aerosols of NH_4NO_3 and $(NH_4)_2SO_4$—are fairly rapidly removed; that is, their residence

times are on the order of hours to a week." (NAS-1, p. 57)

"The North American data therefore suggest that whatever atmospheric processes are taking place, pollutants are being thoroughly mixed over a region with linear dimensions up to 1,000 km." (NAS-2, p. 9)

Can both distant and local sources affect deposition at remote receptors?

"There exists now no acceptable method for determining source-receptor relationships on a scale much smaller than "eastern North America"....Even if a verified model is developed in the future, the source-receptor relationship may be found to be sufficiently complex and variable that emission controls would still need to be assigned over large areas rather than locally."(OSTP, p. III-4)

"Preliminary analyses suggest that about one-third of the total amount of sulfur compounds deposited over the Eastern United States as a whole originates from sources over 500 kilometers (km) (300 miles) away from the region in which they are deposited. Another one-third comes from sources between 200 and 500 km (120 to 300 miles) away, and the remaining one-third comes from sources within 200 km (120 miles)." (OTA, p. 5)

"Based on modeling simulations for summer conditions, one may identify three approximate regions in northeastern United States and eastern Canada in which the relative contributions to acidic depositions due to emissions from near (< 500 km) versus distant (> 500 km) sources may be significantly different. In the upper Ohio River Valley (a dense source region), sources within 500 km appear to dominate the maxima of ambient SO_2 and aerosol sulfate concentrations, as well as the total wet and dry depositions of sulfur. At the other extreme, in upper New England and parts of eastern Canada which are remote from major sources of sulfur, long-range transport may be responsible for most of the aerosol sulfate and total wet deposition of sulfur. In the intermediate regions, including the Adirondacks, contributions to total acidic depositions from near and far sources may be more comparable, considered on a regional and summer average basis. These simulations have a minimum resolution of about 100 km and thus do not reflect local source 'hot spots'." (CARP I, p. 3-90)

"Recent studies of air-mass trajectories at Whiteface Mountain in the Adirondacks indicate that 62 percent of the sulfate ion and 65 percent of the nitrate ion are deposited by precipitation associated with air parcels emanating from the Ohio River Valley and midwestern States." (NAS-2, p. 103)

"The evidence of the air-parcel trajectory studies at specific receptor sites in remote areas of the northeastern United States suggests that the industrialized region to the southwest is a major source of both nitric and sulfuric acids deposited at the sites." (NAS-2, p. 108)

"The spatial distribution of the annual average molar ratios of pollutants in emissions and deposition suggest that atmospheric processes in eastern North America lead to a thorough mixing of pollutants over a wide geographic area, making it difficult to distinguish between the effects of local and distant sources." (NAS-2, p. 140)

C. *What are the relative contributions of wet and dry processes to deposited sulfur and nitrogen?*

"A substantial fraction of such (SO_2 and NO_x) emissions returns as sulfate and nitrate in rainfall; a comparable amount returns as "dry" deposition through surface-interaction processes which are more difficult to monitor than "wet" deposition." (OSTP, p. III-2)

"Averaged over the Eastern United States, about equal amounts of sulfur compounds are deposited in wet and dry forms. However, in areas remote from pollution sources, such as the Adirondacks, wet deposition may account for up to 80 percent of the sulfur deposited; in urban areas near many sources of pollution the situation is reversed." (OTA, p. 5)

"As a rule of thumb, for sulfur and nitrogen compounds at least, dry deposition is taken on the average to be about as effective as wet deposition in pollutant removal. About one third of sulfur emissions is transported out of the continent. Thus roughly one third of northeastern emissions is assumed to be dry-deposited on the North American continent." (NAS-2, p. 46)

D. *How do wet deposition, dry deposition, total deposition and precipitation acidity vary with changes in sulfur dioxide emissions?*

"On the global scale, the sulfur system is clearly linear, for all the sulfur emitted is deposited (sulfur does not accumulate in the atmosphere the way longer-lived constituents such as carbon dioxide and the Freons do). On the smallest scale, sulfur is highly nonlinear, for it is easily transported away from the point of emission. On intermediate scales, such as the size of

eastern North America, the degree of linearity must be intermediate." (OSTP, p. VI-11)

"Reducing sulfur oxide emissions will reduce the total amount of acid formed in the atmosphere, *if* levels of nitrogen oxides and hydrocarbons remain constant, and chemical reactions are not limited by a shortage of oxidizing agents. Furthermore, given these conditions, a decrease in sulfur dioxide emissions should decrease total sulfur deposition by an approximately equal proportion. *Where* deposition will decrease can only be estimated on a regional scale." (OTA, p. 73)

"Assuming that the ambient molar concentrations of NO_x and basic substances (such as ammonia and calcium carbonate) remain unchanged, we conclude that a reduction in sulfate deposition will result in at least as great a reduction in the deposition of hydrogen ion." (NAS-2, p. 84)

"On the basis of currently available empirical data and within the limits of uncertainty associated with the data and with estimating emissions, we therefore conclude that there is no evidence for a strong nonlinearity in the relationships between long-term average emissions and depositions in eastern North America." (NAS-2, p. 31)

II. Questions on aquatic ecosystems

A. *Have lakes and streams in the United States been acidified by acid rain?*

"Acid precipitation contributes to the greater-than-natural hydrogen-ion levels in some lakes and streams in eastern North America" (OSTP, p. III-2)

"There is no question that fresh water bodies in sensitive areas have been altered." (OSTP, p. III-5)

"Substantial evidence indicates that acid deposition alters water chemistry in sensitive lakes and streams." (OTA, p. 41)

"Although there can be significant problems with comparing old and new data, overall, the analysis of temporal records shows recent decreases in alkalinity and pH in *some* otherwise undisturbed streams and lakes in areas receiving acidic deposition. As yet, no body of evidence exists suggesting that changes of such magnitudes, and at such rates, occur in otherwise undisturbed areas not receiving acidic deposition." (CARP II, p. 4-167)

"Although acidic waters do not occur naturally, in some cases, and changing land use may locally alter the pH regime of surface waters, it appears that regional acidification and episodic pH depressions (pH < 5.0) in clearwater oligotrophic lakes and streams occur only in response to increased atmospheric deposition of strong acid. In areas *not* receiving acidic deposition, but with identical changes in land use, regional acidification of clearwater oligotrophic surface waters has *not* occurred." (CARP II, p. 4-168)

"Due to acidic deposition, SO_4^{2-} concentrations have increased in aquatic systems in much of eastern North America. The increase in SO_4^{2-} problem *has to have been* matched by an increase in C_B or H^+. Since aquatic systems with original low alkalinities are characterized by watersheds with low C_B/H^+ ratios in the soil, a large portion of the increase in SO_4^{2-} will have to be matched by an increase in H^+, i.e., decreased alkalinity." (CARP II, p. 4-112)

"There is empirical and theoretical evidence for lake and stream acidification." (NAS-3, p. 10)

B. *What are the estimates of the past, current and future rates of acidification?*

"...about 3,000 lakes and 23,000 miles of streams have already become acidified, or have so little acid-neutralizing capability left that they are extremely vulnerable to further acid deposition. This corresponds to about 20 percent of the lakes and streams found in identified sensitive areas." (OTA, p. 43)

"If sulfate deposition were decreased by 20 percent, OTA estimates that 10 to 25 percent of these water bodies might show improvement. If sulfate deposition were reduced by 30 percent, about 15 to 40 percent might show improvement. If sulfate deposition were increased by 10 percent, OTA estimates that acid-alteration of lakes and streams might intensify by about 5 to 15 percent." (OTA, p. 43)

"Scandinavian and North American studies appear to agree on one point: acidification of sensitive waters is detectable within one to two decades where pH values of precipitation are less than 4.6—a 10-fold increase in acidity over the theoretical "pure" rain pH value of 5.6. In areas where precipitation has pH values of 4.0 to 4.3, degradation is much more rapid. Changes in the pH or alkalinity of water bodies of small areas of Belgium, the Netherlands, and Denmark also have been recorded." (NAS-1, p. 153)

"Theoretically, in lakes and streams impacted by acid deposition, where sulfate concentrations are still increasing, the alkalinity will continue to decrease. With respect to lakes and streams affected by acid deposition, where sulfate con-

centrations are stable, there is disagreement in the panel as to whether future alkalinity decreases will be gradual over the period of centuries or perceptible over years to decades. The disagreement stems from a lack of data." (NAS-3, p. 11)

C. *Are there biological changes due to acidification of lakes and streams?*

"Although some kinds of lakes have been acid throughout their known history, others in areas subjected to acid deposition have become appreciably more acid during the past few decades. These changes in lake acidity have been accompanied by major changes in the biological activity within them, often including the disappearance of various aquatic biota, most visibly fish." (OSTP, p. III-2)

"In lakes near very strong sources of sulfur dioxide, such as the smelters of Sudbury, Ontario, ecological effects have been severe. Thus, there can be no doubt that high loadings of acid can destroy the normal biology of a lake." (OSTP, p. V-4)

"Fish are sensitive both to the acidity of water, and to toxic metals—primarily aluminum—that are released from the watershed under acid conditions. When waters become more acid than pH 5, many fish species are eliminated and major changes in lake ecosystem processes frequently occur. High acidity, toxic concentrations of metals such as aluminum, or some combination of the two appear to cause these changes." (OTA, p. 42)

"Biological effects due to acidification occur for a few species near pH 6.0. Because the biological response to acidification is a graded one, continued pH declines below pH 6.0 will result in escalating biological changes, with many species adversely affected in the range pH 5.0 to 5.5. Long-term declines in pH, commonly to pH 4.5 to 5.0, have been observed for a number of lakes and streams in areas receiving acidic deposition. For the same waters, historical data and paleolimnological analyses indicate that pH levels were often mid 5's or higher prior to acidification. In addition, episodic depressions down to pH 4.4 to 4.9 often occur in low alkalinity waters during periods of snowmelt and heavy rainfall and can affect systems with a pH as high as 7.0. These pH levels, along with other changes associated with the acidification process (e.g., increased aluminum, clarity, accumulation of detritus and algal mats), will have significant harmful effects on aquatic organisms. In waters where pH values average below 5.0, most fish species, virtually all molluscs, and many groups of benthic invertebrates will be eliminated. Increased aluminum concentrations may eliminate fish species otherwise tolerant of low pH. The plankton community will be simplified and dominated by a few acid-tolerant taxa. Benthic algal mats will often cover the lake bottom, and water clarity may increase. These represent the best documented effects of acidification. Effects on ecosystem processes remain largely unconfirmed and are an important area for future research efforts." (CARP II, p. 5-159)

"Addition of acidic deposition to terrestrial and aquatic systems can disrupt the natural biogeochemical cycles of some metal and organic compounds to such a degree that they can cause biological effects. The chemical form of dissolved metals is important in determining the total mobility of a metal and the biological effects related to acidification of aquatic ecosystems. Acidification increases the concentration of many metals in surface waters and changes speciation toward more biologically active forms." (CARP II, p. 4-168)

"Acid deposition, due to the further oxidation of sulfur and nitrogen oxides released to the atmosphere by anthropogenic sources, is causing widespread damage to aquatic ecosystems, including loss of bicarbonate, increased acidity, and higher concentrations of toxic metals. As a result, several important species of fish and invertebrates have been eliminated over substantial parts of their natural ranges." (NAS-1, p. 182)

"If lakes and streams have been acidified by acidic deposition then biological effects will follow. Because the chemical changes are for the most part gradual and variable, 15 years is too short a period over which to evaluate biological trends. However, streams and lakes acidified by acidic deposition have a different biotic structure than nonacidified streams and lakes." (NAS-3, p. 4)

D. *If sulfur emissions are reduced, how long will it take lakes and streams to return to their previous chemical and biological conditions?*

"Lakes and streams require years or decades to recover from anthropogenic acidification once the acidic inputs are removed, with the recovery time depending on local geochemical factors, flushing rates, rates of species colonization, extent of alteration of trace-element composition, and other factors." (OSTP, p. III-5)

"These systems have responded to increases in acid deposition in the past and will respond to future changes in acid deposition. In

watersheds that retain significant quantities of sulfate, lakes and streams that have responded more slowly to acid deposition will continue to respond to past levels of acid deposition and will exhibit slow response to any future increases or decreases in acid deposition." (NAS-3, p. 8)

III. Questions on terrestrial ecosystems

A. *Does acidic deposition alter forest ecosystems?*

"Forest damage has been increasing in eastern North America during the past few decades; acid deposition may be a contributor." (OSTP, p. III-2)

"Acid deposition might be harming trees in two ways: either directly (e.g., by removing nutrients from leaves), or indirectly, by altering the soils on which trees grow....Acid deposition might be stripping such essential nutrients as calcium and magnesium from these soils, or releasing metals, such as aluminum, that are toxic to plants. Whether this nutrient loss or release of metals from the soil is large enough to affect forest productivity at current levels of acid deposition is unknown." (OTA, p. 12)

"At present we have no direct evidence that acidic depopsition currently limits forest growth in either North America or Europe, but we do have indications that tree growth reductions are occurring, principally in coniferous species that have been examined to date, that these reductions are rather widespread, and that they occur in regions where rainfall acidity is generally quite high, or pH is low (< pH 4.3) for an annual average." (CARP II, p. 3-63)

"Addition of acidic deposition to terrestrial and aquatic systems can disrupt the natural biogeochemical cycles of some metal and organic compounds to such a degree that they can cause biological effects. The chemical form of dissolved metals is important in determining the total mobility of a metal and the biological effects related to acidification of aquatic ecosystems. Acidification increases the concentration of many metals in surface waters and changes speciation toward more biologically active forms." (CARP II, p. 4-168)

B. *Does acidic deposition alter soils?*

"Acid deposition can remove essential nutrients such as calcium and magnesium from the soil, but the *rate* of removal—the importance relative to other factors—is difficult to determine. Moderately acid soils are thought to lose nutrients at a faster rate than more acid soils, but the more acid soils typically have less nutrients." (OTA, p. 45)

"Though relatively rare in the Eastern United States, some moderately acid soils might further acidify from nutrient loss over decades of exposure to acid deposition. About 1 to 5 percent of the Eastern counties (depending on the soil criteria used) are dominated by soils of this type." (OTA, p. 45)

"Increased leaching of potassium, calcium, aluminum, and magnesium due to ion exchange reactions with hydrogen ions is one of the most commonly observed effects of acid precipitation. These increased rates of leaching appear to outstrip compensatory increases in weathering, reducing the exchangeable pool of the above cations." (NAS-1, p. 173)

"The long-term effect (i.e., over decades or centuries) of acidic deposition can be expected to remove cations from forest soils, but it is not clear whether this will reduce available cations and enhance acidification of soils. For example, cation leaching rates, although increased by acid precipitation, may remain insignificant relative to total soil supplies and forest growth requirements; furthermore, exchangeable cations may be replaced by weathering from primary minerals at rates sufficient to maintain their current status partially as a result of acid precipitation inputs." (CARP II, p. 2-55)

"The soils most susceptible to rapid acidification are well-drained brown forest soils (alfisols) that are sandy and noncalcareous but not already strongly acid. Such coarse soils are moderately to highly saturated by "basic" cations such as Ca^{++}, Mg^{++}, K^{+}, and Na^{+}, which are leached away as they are replaced by "acid" cations such as hydrogen ions, aluminum ions, and hydroxy-aluminum ions. As the exchange complex becomes dominated increasingly by the "acid" cations, the pH of the soil declines. Fine-textured mineral soils, because of their high clay content, have a much greater cation-exchange capacity, which is usually strongly saturated by "basic" cations, and such soils are much better buffered against acidification.

Strongly acid podzol (spodsol) soil horizons—whether organic, with a high cation-exchange capacity, or sandy, with low cation-exchange capacity—are only slightly susceptible to further acidification. Their exchange sites are already dominated by the "acid" cations, and thus added hydrogen ions are more likely to pass through the system in the percolating waters. Neverthess, because such soils are already im-

poverished, even slight losses owing to increased acidification may be critical for soil fertility." (NAS-1, p. 172)

"Another important terrestrial effect of acid deposition may be on cycling of nutrients by bacteria, blue-green algae, and fungi. For instance, pHs of 3.2 inhibit mineralization of glucose in soils, pHs of 3.0 to 4.0 reduce decomposition of plant litter, and pHs below 6.5 decrease sulfur reduction in soils. Because the cycling of nutrients is such a critical function of the biosphere, any adverse effect could be significant. More research in this area is needed, particularly in wetlands, lake and river sediments, and terrestrial soils." (OSTP, p. V-9)

"Forest soils may be altered by acid deposition with either beneficial or harmful results. The nitrates and sulfates from acid deposition can supply essential plant nutrients. In many areas, nitrogen in the soil is in short supply; on these soils nitrates in acid rain might improve forest productivity. Sulfur-deficient soils, however, are quite rare. On nutrient-poor acid soils, especially those where sulfate can travel freely through the soil, further nutrient loss—even at a slow rate—from the soil, forest canopy, and decomposing plant material might be significant. About 15 to 20 percent of the Eastern counties meet these criteria, but whether nutrient loss is significant enough to affect near-term forest productivity is unknown." (OTA, p. 45)

"A number of soil microbial processes appear to be affected by acidification. Reduced soil pH may cause a reduction in nitrogen fixation, although mineralization of organic nitrogen may increase. Increased acidity also causes nitrification to decrease; nitrification usually ceases entirely at about pH 4.0. There may be some degree of acclimation in acid environments. Denitrification, the main means by which nitrogen is released to the atmosphere from the biosphere, is also affected by acidification. Decreased rates, and a change in end product from molecular nitrogen to nitrous oxide, are observed in anoxic environments at pH values less than 6.0. At lower pH levels an appreciable yield of nitric oxide is observed, which is phytotoxic." (NAS-1, p. 177)

"It appears that the detrimental effects of acidification on soils may not be due to—or at least, wholly attributable to—acidification *per se* but may be caused by the altered concentrations of nutrients and heavy metals in acidified soils. Direct toxicity of hydrogen ions in soils was found to be negligible over the pH range 4 to 8; around pH 3 roots may be injured and above pH 8 phosphate absorption may be inhibited. In general, pH affects plant growth—by influencing the concentrations of different ions in the soil solution. Some of the elements affected are major plant nutrients (e.g., calcium, potassium, phosphate, nitrate), while several trace elements (e.g., manganese, copper, zinc) may be nutrients at low concentrations and toxicants at high concentrations, as for example around metal smelters." (NAS-1, p. 179)

"Short-term studies indicate that increased H^+ loading will cause increased loss of cations and organic components from forest litter. Over the longer term, the biologically mediated mineralization of organic matter in forest soils will be only slightly inhibited by acidic deposition (< 1 to 2 percent decrease in decomposition rate). Unless average precipitation inputs were to drop to pH 3.0 or below, significant impacts of acidic deposition on litter decomposition in natural systems are not expected." (CARP II, p. 2-55)

"At high concentrations, acidity can release, or "mobilize," aluminum from soil minerals; this may lead to toxic effects on biota in both lakes and forest soils." (OSTP, p. III-5)

"Naturally acidic soils occur fairly extensively, being the predominant soil type in about half the counties east of the Rocky Mountains covered by forest or rangeland. In about one-third of these acidic soils, the strong, freely moving acids from acid deposition can release aluminum and other toxic metals from the soil. However, whether toxic metals are released in sufficient quantities to affect forest productivity is unknown." (OTA, p. 45)

"Differences in effects of different levels of acidification upon trace metals in soils are even less well understood. The only detailed study is that ... in which purely organic *mor* humus layers from Swedish spruce forests were leached in the laboratory by simulated rain acidified to 5 different pH levels. Two sets of humus layers were examined, one far from and the other near to a brass mill. The simulated rain at pH 4.2...released (over 125 days) substantial percentages of several trace metals in the control humus layers, notably manganese..., nickel..., cadmium..., and zinc.. Percentage release was much less for the other metals, copper..., vanadium..., chromium..., and lead.. With the notable exception of vanadium release..., percentage releases were generally less in the humus layers of the polluted site.." (NAS-1, p. 173)

"Aluminum toxicity may affect forests on already acid soils when acidic deposition plus natural acidifying processes increase acidity enough to cause a significant rise in Al availability. If soil pH is low enough (pH 5.0 to 5.5) in

mineral soils to cause the dissolution of Al- and Mn- containing minerals. H + input will increase release of Al and Mn to the soil solution." (CARP II, p. 2-53)

"Addition of acidic deposition to terrestrial and aquatic systems can disrupt the natural biogeochemical cycles of some metal and organic compounds to such a degree that they can cause biological effects. The chemical form of dissolved metals is important in determining the total mobility of a metal and the biological effects related to acidification of aquatic ecosystems. Acidification increases the concentration of many metals in surface waters and changes speciation toward more biologically active forms." (CARP II, p. 4-168)

C. Does acidic deposition affect trees and plants directly?

"...terrestrial effects of acid precipitation may be extremely important, and may rival or exceed those in surface waters. Laboratory experiments have shown that acid deposition adversely affects both plant growth and foliage. In the natural environment, however, the effects are not so clear because acid rain is only one of several stresses on plants, some others being ozone, SO_2, metals, and droughts. Also, it is often difficult or impossible to distinguish effects of direct deposition to the exposed plant from effects of increased ground-water acidity or leaching of essential micronutrients on root systems." (OSTP, p. V-8)

"Acid deposition can remove essential nutrients such as calcium and magnesium *directly* from tree foliage. If the rate of nutrient loss is greater than can be replaced through the roots, nutrient deficiency will result. Scientists do not know which tree species are most susceptible to foliar nutrient loss, or the level of acid deposition at which such loss becomes harmful." (OTA, p. 44)

"Available experimental results do not appear to indicate that the negative effects of acidic precipitation outweigh the positive effects, however, many crops and agricultural systems have not been properly or adequately studied." (CARP II, p. 3-63)

IV. Does acid deposition damage structures and monuments?

"While there is strong evidence for damage to limestone monuments, bridges, buildings, and other structures from SO_2 and other corrosive gases, there is no good estimate of the economic magnitude of these effects or of the contribution from acid deposition." (OSTP, p. III-5)

"Air pollution damages a broad range of materials—including building stone, rubber, zinc, steel, and paint. Ozone is the pollutant that most affects rubber, while many other materials are chiefly affected by sulfur oxides. Humidity plays a key role in materials damage—dry-deposited sulfur dioxide and sulfate that dissolve on moist surfaces (forming concentrated sulfuric acid) may cause greater damage than relatively less acidic rain. Since air pollution is only one of many environmental factors (e.g., temperature fluctuations, sunlight, salt, micro-organisms) that cause materials damage, it is difficult to determine what proportion of damage it accounts for. Moreover, it is difficult to determine the proportion of materials damage caused by transportation pollutants as opposed to local pollution sources." (OTA, p. 46)

V. Do compounds of sulfur and nitrogen affect visibility?

"...degradation of visibility by fine-particle acidic aerosol is real and widespread. While it is true that its effects show up most clearly in the West, where virtually unlimited visibility surrounding scenic vistas is expected, we differ from Work Group I on the relative importance of visibility there. Preoccupation with the West is largely cultural. Eastern North America has many regions with great vistas which are widely valued when seen. When weighted for the larger number of people in the East, we believe that maintaining visibility there is at least as important as in the West. Once one becomes attuned to atmospheric optics, reduced visibility can be just as annoying over distances of 5 miles as over 150 miles." (OSTP, p. V-10)

"Sulfate concentrations correlate well with visibility impairment over large regions of the United States; in the East, sulfate appears to be the single most important contributor to visibility degradation. Recent studies suggest that sulfates account for 70 percent of visibility impairment during the summer, and 50 percent annually, in the Eastern United States. Nitrates rarely contribute substantially to visibility degradation in the East. However, in the Western United States, windblown dust and nitrogen oxides can also reduce visibility significantly." (OTA, p. 47)

"At eastern rural sites sulfate accounts for a large part of the fine particle mass and the light extinction." (CARP II, p. 5-82)

"At western locations nitrate and carbon-containing particles make a substantial contribution to fine particle mass and to light extinction." (CARP II, p. 5-83)

VI. **Do acid deposition and its precursor pollutants affect human health?**

"We accept the assertion that acidic deposition does not directly affect human health. Even indirect effects such as increases in aluminum or lead in water supplies appear to have no immediate health effect, although they should be monitored." (OSTP, p. V-10)

"Disagreement exists within the scientific community over the significance of airborne sulfates to human health. Some researchers conclude that there is a negligible effect at prevailing concentrations; others have found a significant association—several percent of annual mortality, primarily among people with preexisting cardiac or respiratory problems. By combining the various estimates, this study concludes that a reasonable estimate of the magnitude of health risk posed by current levels of sulfates and other particulates is about 50,000 premature deaths (2 percent of total deaths) per year in the United States and Canada. This estimated health risk from transportation air pollutants is a measure of *possible* harm. It can neither be confirmed nor disproven until further research is conducted.

Acidified waters can dissolve metals and toxic substances from soils, rocks, conduits, and pipes, and subsequently transport them into drinking water systems. Municipal water supplies can be monitored and corrected quite easily; potential problems with well water in rural areas are more difficult to detect and mitigate." (OTA, p. 13)

"No adverse human health effects have been documented as being a consequence of metal mobilization by acidic deposition. On the other hand, interest in the phenomena of acid deposition is recent and few investigations, if any, have been made into the possibility of indirect effects on human health." (CARP II, p. 6-56)

"Potential impacts of acidic deposition on methyl mercury concentrations in freshwater are of great interest for several reasons.
a) Fish and fish products are the major if not the only sources of methyl mercury for humans.
b) Consumers of freshwater fish have a greater possibility of exceeding allowable daily intakes of methyl mercury than do consumers of other forms of fish.
c) Pike and trout, freshwater fish among the most likely species to be affected by acidic deposition, have the highest user consumption figures and the highest average methyl mercury levels." (CARP II, p. 6-56)

"People receiving drinking water from roof-catchment cistern systems should be considered a potential risk of increased intake of lead in areas of acidic deposition and especially if cisterns that are used have no particulate filters." (CARP II, p. 6-57)

"From the point of view of human health risks, any increases of lead concentrations in drinking water should be viewed as an additional burden of lead. This is especially important where substantial numbers of children already have elevated blood lead levels." (CARP II, p. 6-57)

"Acute or chronic diseases in humans have not been related to normal dietary intake of aluminum from food or drinking water. However, a potential threat exists for patients undergoing hemodialysis if aluminum concentrations in the water used in this treatment exceed 50 μg of aluminum per liter." (CARP II, p. 6-57)

VII. **On the basis of current information, what steps should be taken to abate the effects of acid rain?**

"The Clean Air Act of 1970 marked the formal recognition by the United States government of the importance of reducing emissions of sulfur and nitrogen oxides to the atmosphere. New power plants constructed since 1970 do control such emissions to lower levels. Such controls were a prudent first step, but have not accomplished all that was initially intended. We recommend that additional steps should be taken now which will result in meaningful reductions in the emissions of sulfur and nitrogen compounds into the atmosphere, beginning with those steps which are most cost-effective in reducing total deposition. Emission reductions are meaningful when they produce a detectable decrease in both acidic deposition and degradation of the biosphere." (OSTP, p. III-1).

"Reducing present SO_2 emissions would reduce depositions of total sulfur, and, consequently, both reduce the probability of major degradation of additional acid-sensitive lakes or forests and allow anthropogenically adicidied areas to begin to return to their original condition." (OSTP, p. III-4)

"Four approaches for congressional action on acid deposition and other transported air pollutants are discussed below.

A. Mandating emissions reductions to further *control the sources* of transportation pollutants.
B. Liming lakes and streams to *mitigate some of the effects* of acid deposition.
C. Modifying the Federal acid deposition research program to *provide more timely guidance* for congressional decisions.
D. Modifying existing sections of the Clean Air Act to *enable the Environmental Protection Agency, States, and counties to more effectively address transportation air pollutants other than acid deposition.*

Congress could choose to adopt some or all of these approaches in its consideration of clean air legislation. A comprehensive strategy to address transportation air pollutants might well include options from all four of the approaches." (OTA, p. 15)

"Of the options presently available only the control of emissions of sulfur and nitrogen oxides can significantly reduce the rate of deterioration of sensitive freshwater ecosystems. It is desirable to have precipitation with pH values no lower than 4.6 to 4.7 throughout such areas, the value at which rates of degradation are detectable by current survey methods, as mentioned above. In the most seriously affected areas (average precipitation pH of 4.1 to 4.2), this would mean a reduction of 50 percent in deposited hydrogen ions. Control of SO_2 from new electrical generating plants alone would be insufficient to accomplish this, and thus restrictions on older plants must be considered. Furthermore, there are no proposed restrictions on the emission of nitrogen oxides, and the amounts of these substances emitted are expected to continue to increase." (NAS-1, p. 181)

APPENDIX

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